SOCIO-ECONOMIC SURVEY
OF
SMALLHOLDER FARMING SYSTEMS IN SOLOMON ISLANDS

FOTE
MALAITA PROVINCE

Agricultural Economics Section
Rural Services Project
Ministry of Agriculture and Lands
Solomon Islands

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Abbreviations and Units of Measure

AES	Agricultural Economics Section (RSP)
CEMA	Commodities Exporting and Marketing Authority
DCRS	Dodo Creek Research Station
LDA	Livestock Development Authority
MAL	Ministry of Agriculture and Lands
PBME	Project Beneficiary Monitoring and Evaluation (RSP)
RDC	Rural Development Centre (RSP)
RSP	Rural Services Project
km	kilometre = 1,000 m
ha	hectare = 10,000 sq m
m	metre
MT	metric tonne = 1,000 kg
SI$	Solomon Islands Dollar

Acknowledgements

The present report is produced by the staff of the Agricultural Economics Section. The Section was established under the ADB/IDA/IFAD assisted Rural Services Project and is engaged in a two years socio-economic study of smallholder farming systems throughout Solomon Islands, extending from 1987 to 1989.

Many others contributed to the planning of the programme and in its implementation. The study would not have been possible without the support and patience of local people. To them we are grateful and hope that the present report will be in some way of benefit.

We would like to thank members of the Ministry of Agriculture and Lands, in particular the Director of the Rural Services Project and staff, and the Chief Research Officer and staff for their support throughout.

The Statistics Office of the Ministry of Finance has assisted the survey through the generous lending of equipment, canoes and outboards, and in sampling. Thanks are especially due to Richard Harris, Rural Statistician, for his interest in the survey from the outset.

Not least, thanks are extended to the Premier of Malaita Province, the Provincial Secretary and staff, the Principal Field Officer and members of the agricultural extension service for their support in establishing the survey. It is especially hoped that the present report will find a practical application in development works being undertaken in the Province.

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Chapter: 1
INTRODUCTION

1.1 The Solomon Islands comprise a double chain of islands extending in a north-west south-east direction over 860km of the south-west Pacific between latitudes 5°-12°S and longitudes 155°-170°E. The islands lie directly along a major line of crustal weakness traversing the western Pacific and are the surface expressions of fault-bounded blocks and troughs originating in a zone of geologically intense activity. Warping and block movement are the most significant geomorphic processes responsible for the elevation of land to its present altitude, with marine sediments occuring on some of the highest ranges. Such processes continue spasmodically and raised reefs at various heights occur in many parts of the country, as does intense faulting. Earthquakes are frequent and often initiate land movements in ground already close to shearing point such as saturated soil at the heads of steeply incised gullies, resulting in debris slides among the high ridges (10).

1.2 Solomon Islands lies well within the geographical tropics in an oceanic area where two contrasting trade winds meet, a low-pressure belt of ascending air known as the "inter-tropical convergence zone" (ITCZ). In this zone warm and humid air masses drawn from equatorial regions meet relatively cool and dry sub-tropical air derived from the south-east. From about March to November the islands experience steady, shallow, south-easterly winds. During November and December unsettled weather is likely as the ITCZ moves south over the islands, from which follows steady north-westerly winds. March and April are again unsettled as the ITCZ returns northwards until the south-easterly trade winds become re-established. Cyclonic disturbances may be generated, particularly around December and April when the convergence of the two air streams is strongest. Weather is varied, both temporally and spatially, but is characterised by continally high average temperatures and humitity. Most land areas have a mean annual rainfall of 3,000-5,000mm with variations depending on latitude and orientation to prevailing winds. Temperatures are more uniform, at around 26°C in the lowlands, and never reach extremes which would restrict plant growth. Night time humidity exceeds 90%. This may fall to 60% on clear sunny days, or remain close to saturation point during cyclonic conditions (10).

1.3 The islands are rugged, with a predominance of ridge-valley landscapes and high relief. Undulating rolling landscapes have a limited distribution and extensive fluvial plains are uncommon. Chemical weathering is intense under conditions of continuously high temperature and moisture, however, soil depths are not generally great. Most hill areas have slopes exceeding 12-15° and commonly reach 35-55° among the mountain ridges. Continual soil wash and creep and periodic mass movements effectively keep pace with rock weathering. Only on stable flatter sites do deep profiles develop. The islands for the most part are covered in dense forest, some fire disclimax grassland in parts of Guadalcanal and Florida Islands, and land cleared or cultivated[10].

1.4 The population of Solomon Islands from the 1986 census was 285,176, with an annual growth rate of 3.5%. The land area of 28,370sq km gives a low overall population density of 10 persons per sq km. Settlements are mostly along the coastal margins so that in some parts of the country population densities are high.

1.5 The population distribution of Solomon Islands is summarised in diagram 1.1 and key socio-economic data are presented in table 1.1

1.6 There is a considerable variation between land area and population among the provinces. While Western Province accounts for 33% of the national land area it contains only 19% of the population. The West is characterised by low population density compared to provinces such as Central, Malaita and Temotu. Although Temotu contains 5% of the national population it also accounts for only 3% of the national land area, and therefore has a relatively high mean population density. Land area in Solomon Islands is summarised in diagram 1.2.

Table: 1.1
SOLOMON ISLANDS KEY DATA

Province	Western	Ysabel	Central	Guadalcanal	Honiara
POPULATION					
1986 population	55,250	14,616	18,457	49,831	30,413
annual growth rate	3.0	3.2	2.9	4.3	6.8
% national population	19	5	6	17	11
peri-urban population	3,710	1,901	1,622		30,413
% peri-urban	7	13	9	38	
number of households	7,942	2,362	3,079	8,072	4,317
LAND AREA					
land area (sq km)	9,312	4,136	1,286	5,336	22
% land area	33	15	5	19	0
population density/sq km	6	4	14	9	1,382
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)					
revenue	443	173	191	281	1,033
grants	2,556	634	623	1,247	704
current expenditure	3,504	849	750	1,431	1,561
capital expenditure	200	58	88	192	177
net revenue (negative)	(705)	(100)	(24)	(96)	(2)

Province	Malaita	Makira	Temotu	Total
POPULATION				
1986 population	80,032	21,796	14,781	285,176
annual growth rate	2.7	3.6	2.8	3.5
% national population	28	8	5	100
peri-urban population	3,252	2,588	1,295	44,781
% peri-urban	4	12	9	16
number of households	12,417	3,278	2,375	43,842
LAND AREA				
land area (sq km)	4,225	3,188	865	28,370
% land area	15	11	3	100
population density/sq km	19	7	17	10
1987 PROVINCIAL GOVERNMENT REVENUE AND EXPENDITURE (SI$'000)				
revenue	339	485	160	3,103
grants	1,891	1,095	445	9,195
current expenditure	2,190	1,472	615	12,371
capital expenditure	331	600	0	1,646
net revenue (negative)	(291)	(492)	(10)	(1,719)

Source: Statistics Office Statistical Bulletin 15/87 "Provincial Statistics"
Populationa data revised from Statistics Office Statistical Bulletin 3/88 "Solomon Islands Population Census"

POPULATION COMPOSITION

% by province

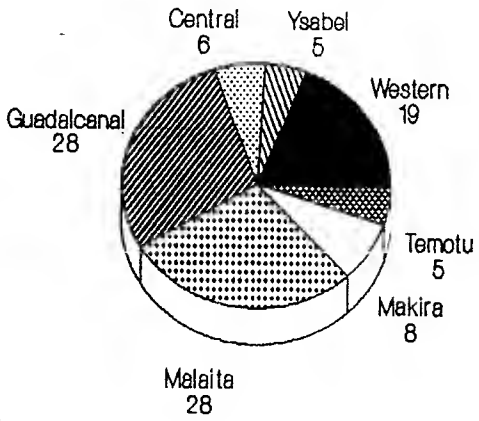


Diagram: 1.1

LAND AREA

% by province

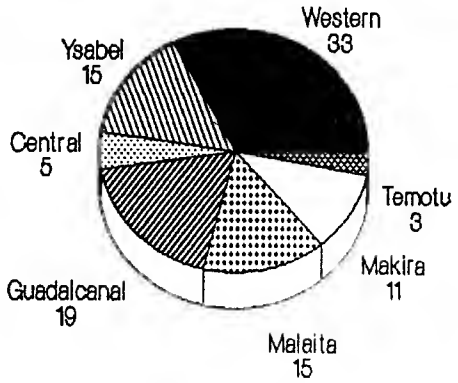


Diagram: 1.2

1.7 While a provincial comparison presents a broad indication of population densities throughout the country, differences within provinces are of significance to agricultural policy. With improvements in communications and administrative links there has been a general migration to the coastal margins where travel and marketing are easier, and where services such as schooling and health are more readily available. The highland interior tends to be sparsely populated in comparison.

1.8 While the overall population density is low, in some areas a growing population pressure is causing concern. Traditional farming systems based on forest fallow may be sustained under conditions of low pressure, but run into soil fertility and related problems when fallow periods are reduced and cropping intensified. Conversely, there are sparsely populated areas of agricultural potential where communications and services are poorly developed. The Rural Services Project is developing facilities in areas of high agricultural potential, providing marketing and transport infrastructure, agricultural and training services, and extending the coverage of adaptive research. These provide new opportunities for agricultural development.

1.9 The capacity of government to implement development programmes is to a large extent determined by funds and resources available. Diagram 1.3 summarises provincial government revenue and expenditure in 1987. Nationally there was a deficit of SI$1.7 million arising through over expenditure in all provinces. Provincial finance is characterised by a low revenue earning capacity, being nationally about one third of the level of central government grants. Revenue and grants are expended almost entirely on basic operating costs, although these remain severely constrained and under-funded. There are little or no funds for development, and investment amounted to only 12% of total expenditure in 1987.

1.10 Agriculture accounted for 42% of export earnings in 1985[11], although this has dropped from the much higher level of 87% in 1960. It is the major employment activity in the country and the source of livelihood for the majority of the population.

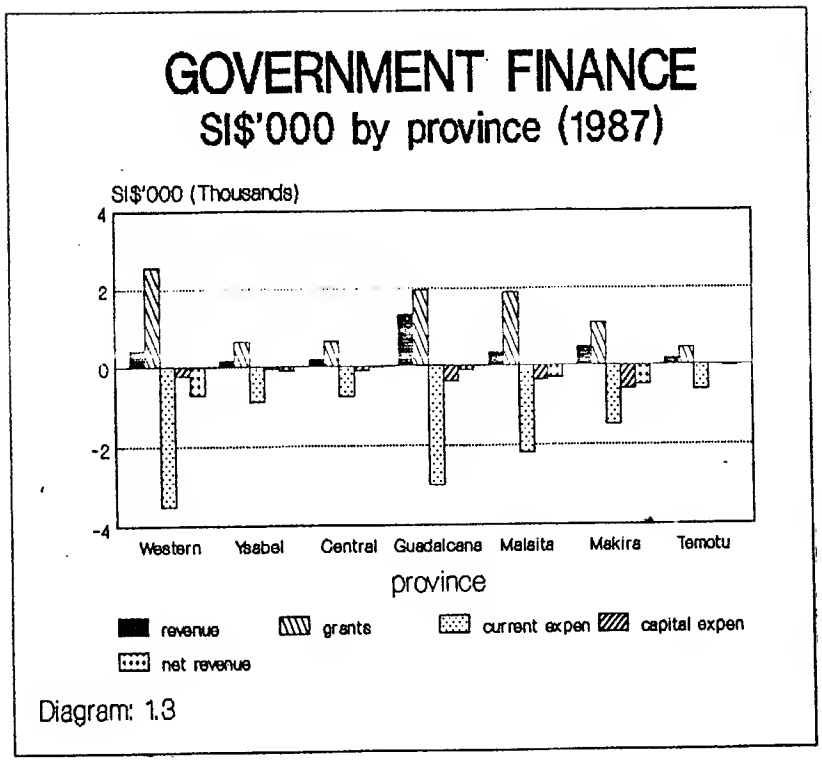


Diagram: 1.3

1.11 Despite various studies undertaken in the past, there is little hard socio-economic data on smallholder farming systems which would assist agricultural policy makers, trainers, extension workers and researchers in the planning, implementation and evaluation of development activities. A national sample survey of agriculture was conducted in 1974-75 [5], but these data are are no longer able to satisfy information requirements.

1.12 The Agricultural Economics Section (AES) was established under the Rural Services Project (RSP) inter alia in order to generate statistical information on smallholder production systems for the quantification of constraints to agricultural development and the devising of appropriate agricultural research programmes. The present study is part of a national survey programme to generate detailed base-line data on smallholder farming systems.

1.13 Since September 1987 AES has conducted a series of farming systems surveys in selected sites throughout the country, such as in the immediate areas of influence of Rural Development Centres or in other areas of special agricultural interest. It is intended that the findings of the survey will find application in the evaluation of development activities, and will assist in the assessment of changes taking place in Solomon Islands agriculture and the formulation of development strategies. The background and justification for the survey programme are documented in the AES Inception Report of 1987 [20]. Methodologies are described in the Agricultural Economics Field Survey Manual [21] and related documents produced by AES.

1.14 The Fote survey in Malaita Province, on the coastal belt between Auki and Dala and in the immediate vicinity of the National Agricultural Training Institute, was conducted in September and October 1988 and covered a sample of 40 rural households. Two stage systematic random sampling was guided by the Statistics Office based on equal probability of household selection, with accessibility taken into account in the definition of the sample frame. Villages were listed from the 1986 population census and selected by systematic random sampling. A pre-determined number of households within each village (or cluster of small villages) were then selected by simple random sampling. Maps of the survey area are presented in diagrams 1.4 and 1.5.

1.15 The survey is designed to investigate the structure and dynamics of smallholder crop and management systems. Of particular importance in the socio-economics of smallholder agriculture is the allocation of labour, since few cash inputs are applied and little wage labour is employed.

1.16 All cultivated areas, including cropped and cleared land, are measured by tape and compass to an error tolerance of 5%. Crop areas are computed and checked in the field by programmable calculator. Data are processed in "dBASE III Plus" databases and analysed through "SPSS/PC+". Raw output is transferred to "Lotus 123 vr 2" spreadsheets for tabulation and secondary processing. Text tables are incorporated into "Wordstar Professional r 4" and graphics are edited in "Harvard Presentation Graphics".

1.17 The Agricultural Economics Programme is sponsored under the Rural Services Project of the Ministry of Agriculture and Lands which is co-financed by the Government of Solomon Islands and ADB/IDA/IFAD. Data processing and the presentation of results has been made possible by the generosity of the Government of New Zealand through its Miscellaneous Technical Assistance Programme. This has overcome a primary constraint to work of this kind in the Ministry of Agriculture and Lands through the provision of computing hardware.

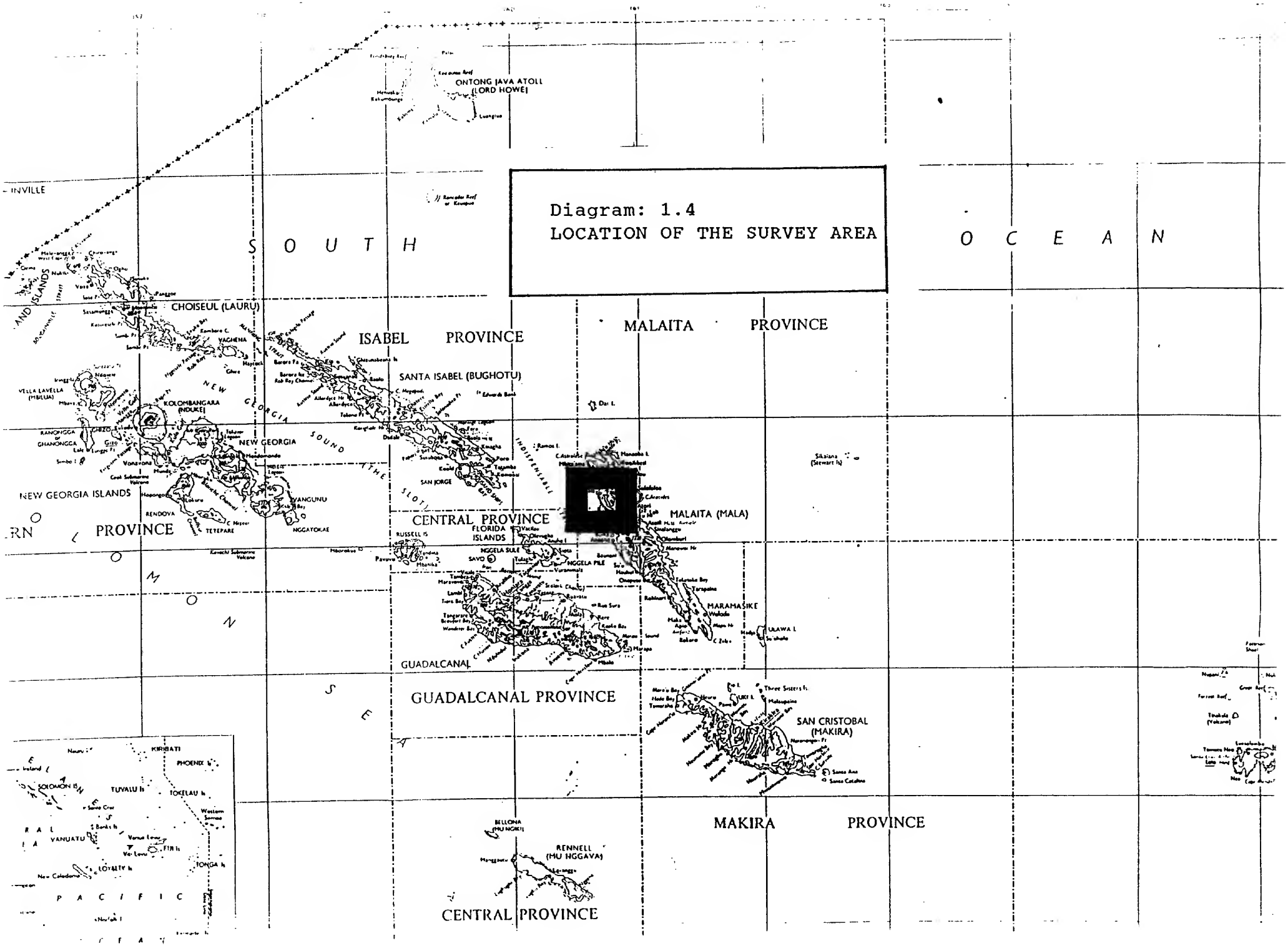
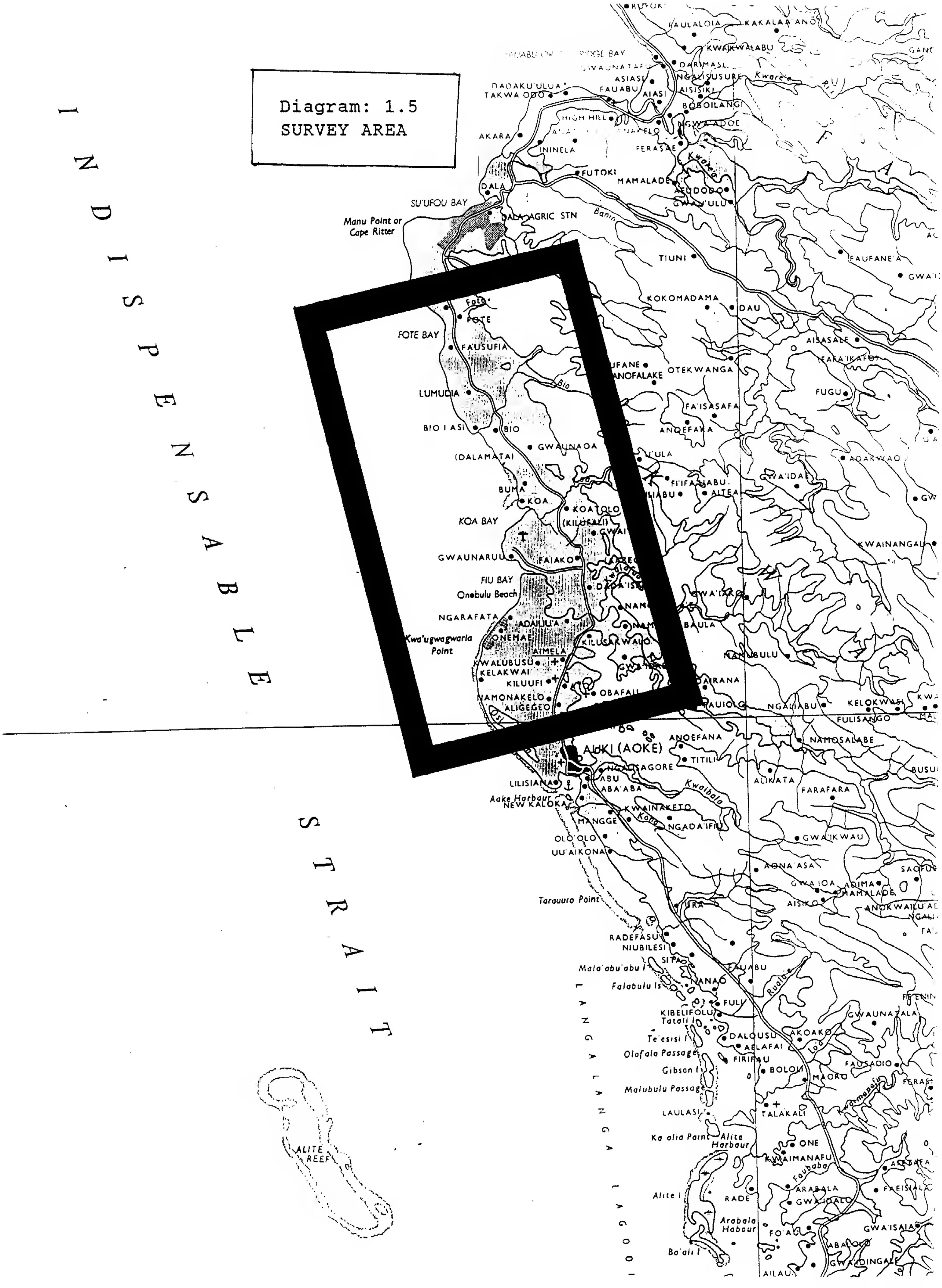


Diagram: 1.4
LOCATION OF THE SURVEY AREA
S O U T H
O C E A N
ONTONG JAVA ATOLL (LORD HOWE)
CHOISEUL (LAURU)
ISABEL PROVINCE
MALAITA PROVINCE
SANTA ISABEL (BUGHOTU)
NEW GEORGIA
NEW GEORGIA ISLANDS
KOLOMBANGARA (NDUKE)
VELLA LAVELLA (MBILUA)
RANONGGA or GHANONGGA
GIZO
VONAVONA
RENDOVA
TETEPARE
MUNDA
VANGUNU
NGGATOKAE
CENTRAL PROVINCE
FLORIDA ISLANDS
RUSSELL IS
SAVO
NGGELA SULE
NGGELA PILE
MALAITA (MALA)
MARAMASIKE
ULAWA I
GUADALCANAL
GUADALCANAL PROVINCE
SAN CRISTOBAL (MAKIRA)
MAKIRA PROVINCE
BELLONA (MU NGIKI)
RENNELL (MU NGGAVA)
CENTRAL PROVINCE
KIRIBATI
PHOENIX IS
SOLOMON IS
TUVALU
TOKELAU
VANUATU
FIJI
TONGA
LOYALTY IS
P A C I F I C
O C E A N

Diagram: 1.5
SURVEY AREA



Chapter: 2
SUMMARY AND MAIN FINDINGS

Household Composition

2.1 The mean household size in the survey area is 6.78, comprised of an approximate balance of 3.58 males to 3.20 females.

2.2 In the sample of 40 households the available labour composition of rural households in the survey area is 2.05male:1.90female, or 52% male to 48% female out of a total of 3.95 adult equivalent labour units per household.

Income Earning Activities

2.3 Rural income earning activities are predominantly food crop sales and professional trades. 55% of households earned income from food crop marketing and 55% of households from professional trades. 15% of households earn income from logging, 18% from the sale of (wet) cocoa beans, and 8% from copra.

2.4 The rural economy shows a strong urban influence. Minor income earning activities include fishing, cooperative or private shops, and skilled trades.

Extension and Mass Media

2.5 42% of households listen to agricultural programmes on the radio, although only 30% listen regularly. Simple written materials may be appropriate in extension since 85% of households have at least one member with some reading and writing ability.

2.6 32% of households are visited by agricultural extension workers, whether government or non-government, but only 11% are visited more regularly than twice per year. 10% of farmers have attended a residential training course.

Livestock

2.7 Livestock, predominantly pigs and chickens, are an important component of smallholder farming systems. 65% of households own pigs with a mean herd size of 3.85 among owners. Chickens are kept by 65% of households with a mean flock size of 13.42 among owners.

2.8 8% of households own cattle with a mean herd size of 7.00 among owners.

2.9 There is no occurence of bee keeping, butterfly or crocodile farming.

Holding Size Distribution

2.10 Two households with no cultivated land are excluded from further analyses, bringing the sample to 38 households. The mean holding size in terms of area cultivated is 0.832ha but the holding size distribution is moderately skewed. 58% of farmers have holdings of less than 0.5ha. The median holding size of 0.327ha indicates that inequalities in the size of holdings should be taken into account in development programmes.

2.11 Inequality in holding size can to a large extent be explained by whether or not farmers have tree crops, notably coconuts and to a lesser extent cocoa. Such holdings tend to be larger than non-tree cropping holdings, with a mean size of 1.553ha and represent 47% of farmers. Conversely non-tree cropping farmers have a mean holding size of 0.183ha and represent 53% of sampled farmers.

2.12 All farmers grow traditional subsistence or food crops, where the area cultivated to these crops is fairly uniform among all farmers. The mean food crop area is 0.251ha and the mean tree crop area is 1.227ha.

Labour Density

2.13 The mean labour availability among 38 households is 4.03 adult equivalent labour units per household, resulting in a mean labour density of 4.84 labour units per hectare. There is a weak association between labour availability and holding size but labour density per unit area falls rapidly from 21.28 labour units per hectare on holdings of less than 0.25ha in size to 1.60 labour units per hectare on holdings of 5-10ha in size. On non-tree cropping holdings the mean labour density is 17.20 labour units per hectare compared with 3.22 labour units per hectare on tree-crop holdings. With such high labour densities labour is unlikely to be limiting and there may be considerable underemployment in agriculture, reflected in employment patterns.

Cropping Patterns

2.14 The average holding size is 0.83ha, however, a distinction is made between farmers with tree crops and those with no tree crops. Of households with tree crops the mean holding size is 1.56ha, of which 1.23ha is under tree crops and 0.33ha is food crops. In contrast non-tree crop farmers have a mean holding size of 0.18ha under food crops. Smallholder cropping patterns are complex and diverse, with 9 dominant crops recorded and a total of 61 distinct mixtures.

Coconuts and Cocoa

2.15 34% of sampled farmers have coconuts and 26% grow cocoa. Most farmers with cocoa also grow coconuts, since 16% of farmers have both coconuts and cocoa (30).

2.16 All coconuts are local tall. 16% are less than 16 years of age and 84% are aged 17-40 years.

2.17 50% of coconut plantings are pure stand and 50% are planted with cocoa. On pure stand coconuts 12% are undercropped with food crops among new stands. 13% are brushed to ground level, 50% brushed to shoulder height and 25% have reverted to secondary bush.

2.18 13% of cocoa plantings with coconuts are less than three years of age, 30% are 3 to 5 years, and 58% are six or more years of age. In pure stand cocoa 20% of cocoa shade is planted, 20% is natural, and 60% is natural and planted.

Fallow

2.19 Fallow in Solomon Islands farming systems is necessary for the maintenance of soil fertility, particularly for the replenishment of potassium in ash following burning. Shifting cultivation has other valuable characteristics, not least its phytosanitary qualities. The fallow period is an indicator of land pressure, and possible fertility and pest problems associated with intensive cultivation. On gardens where it is known, there is a fallow period of 5.2 years, but 47% of gardens have a fallow longer than memory. Root crops are typically grown over 3 to 4 harvests before reverting to fallow.

2.20 54% of all gardens have a fallow of primary or secondary forest on 63% of the cultivated area, with a further 38% under dense shrubby thicket on 19% of the area.

2.21 11% of the food garden area was cut from primary forest compared with 18% of the tree crop area. 16% of the cultivated area has expanded into primary forest, with 47% within secondary forest.

Landform

2.22 83% of tree crop gardens representing 92% of the tree garden area are on the lowland plains. The remainder are on upland, mainly gently sloping, sites.

2.23 Most food crop gardens are also on lowland sites. 76% of food crop gardens representing 89% of the food garden area are on the lowland plain. 24% of gardens representing 11% of the food garden area are on upland, gently sloping sites.

2.24 The mean slope is 3 degrees. 80% of all plots, representing 90% of the total cultivated area are on sites of less than 5 degrees slope. Only 3% of the cultivated area is on slopes of greater than 10 degrees.

2.25 No conservation measures or alley cropping are practiced.

2.26 The mean distance of gardens from households is .190 hours, with a maximum recorded distance of 1.00 hours. There is no apparent association between garden size, crop type, and distance of garden from the household.

Adverse Factors Affecting Production

2.27 51% of gardens representing only 40% of the cultivated area have no apparent site limitations. Poor soil is regarded as a constraint on 17% of gardens (14% of area); pests and disease are a problem on 33% of gardens (17% of area); weeds and related factors are a problem on 20% of gardens and affect 45% of the cultivated area.

2.28 The dominant problem is weeds, particularly on coconut plantings, and pest and disease problems are also extensive.

Crop Yields

2.29 Production data from the farming systems survey need to be reinforced with further yield studies to be undertaken by AES in 1989 and beyond. Indicative yields derived from secondary sources are included in the text.

2.30 In the survey the following yields were obtained:

Yield data from the farming systems survey

	# obs	kg/ha	
copra	1	140	(2 bags/ha)
cocoa (green beans)	8	464	(7.14 bags/ha)
snake bean	1	213	
sweet potato	10	9,081	
Hong Kong taro	1	30,000	(9kg from 3 sq m)

Labour

2.31 The dominant constraint expressed by farmers is on tree crops, where **82%** of the area is affected by a shortage of labour and **73%** is affected by a shortage of inputs or cash. In contrast **10%** of the food garden area is affected by a shortage of inputs or cash only. Distance to gardens not a problem.

2.32 Labour expenditure on the average holding is summarised in table 2.1 - presented firstly by crop (aggregating all operations), and secondly by operation (aggregating all crops).

Table: 2.1
LABOUR SUMMARY

	⟨------ work days per year -----⟩ ⟨----- per holding -----⟩				per ha	⟨- % contribution -⟩			labour cost
	men	women	paid	total	average	men	women	paid	(I)
i) By Crop									
Cleared land	2			2					
Coconut	178	66		244	540	73	27		6
Cocoa	43	7	9	59	524	73	12	15	14
Grain crops					655				
Fruit crops	2			2	279	100			
Sweet Potato	99	378	6	483	2295				17
Taro	6	13		19	1308	32	68		1
Yam	1	1		2	1109	50	50		
Pana					412				
All Crops	331	465	15	811		41	57	2	38
ii) By Operation									
Land Clearance	104	53	10	167		62	32	6	21
Cultivation	32	32	1	65		49	49	2	3
Planting	64	62	3	129		50	48	2	5
Tree Crops Establishment	5			5		100			
Tree Crops Maintenance	12	1		13		92	8		6
First Weeding	29	57	1	87		33	66	1	3
Second Weeding	39	49		88		44	56		
Third Weeding	35	30		65		54	46		
Harvesting	11	181		192		6	94		
All Operations	331	465	15	811		41	57	2	38
Available labour units	:2.05	1.90							
Days per unit labour	: 161	245	15						

Text source: Table 16.3

2.33 Overall there are 811 work days required per year on the average holding, of which 331 are provided by men, 465 by women and 15 by hired labour at an annual cost of SI$38. The average adult man in the household spends 161 days working on the holding and the average adult woman spends 245 days, with an additional 15 days of hired labour.

2.34 Coconuts account for 30% of the holding labour budget and cocoa 7%. Coconuts require of 244 work days per year and cocoa 59 days. Sweet potato requires 483 work days per year and taro 19 days. Overall food crops account for 62% of the annual labour budget. Men provide 73% of the labour on coconuts and cocoa and around one third of the labour on root crops. Women provide 27% of the labour on coconuts, 12% on cocoa and about two thirds of the labour on root crops.

2.35 Men and women contribute fairly equal amounts of labour on the main operations, although women women provide 94% of the labour on harvesting. Overall men contribute 41% of labour on farm, women provide 57% and 2% is hired.

Cash Crop Processing

2.36 While 34% of farmers grow coconuts only 8% earn income from the sale of copra. The labour input in the manufacture of copra is 96% family and 4% hired, at an annual cost of SI$3. Copra production is labour intensive, requiring on average 34 work days per annum to produce 254kg copra, or 8kg copra produced per household work day. At the prevailing price of 33 cents per kilo this offers a net return of SI$2.33 per household work day. The net mean annual income from copra is SI$77.

2.37 18% of sampled farmers earn income from the sale of cocoa in the form of wet beans. The mean annual production is 72kg wet beans. At a household labour input of 6.6 work days this represents a production of 11kg per work day. At the prevailing price of SI$0.70 per kilo the annual income from the production of wet beans is SI$49, or SI$7 per work day.

Marketing

2.38 A summary of prices in the Auki market is as follows:

crop/commodity		<--- price SI$ in 1988 ---> at 25 May		at 15 October					
sweet potato		.29	.31	.97	.38	.62			
taro	common			.50	.67				
	Hong Kong	.29		.32					
pana		.25	.32						
yam		.20	.23						
coconut	dry	.08		.13					
	green	.33		.27					
banana	sweet	.17		.25					
	cooking	.25		.43					
pumpkin		.20		.29					
melon				.71	.83				
pumpkin tips				.46					
taro leaf				.67					
paw paw				.31					
pineapple		.19		.36	.50	.38	.46	.50	.44	.39
hibiscus cabbage		.15		.47	.67	.27			
chinese cabbage				.31					
capsicum pepper				1.00	4.00				
tomato				.33					
watercress				.29					
shallot				1.00					
snake bean				.40					
long bean		1.00							
wing bean		.40							
cucumber		.15							
peanuts		4.00		4.00	3.14				
mangrove fruits				.22					
sugar cane		.11							
ngali nut		.50		2.00					
betel nut		.50		2.00	2.00				
	leaf			3.00					
	stick			1.00					
tobacco				10.00					

2.39 For the most part marketing problems are slight, mostly on transport costs and poor prices at market.

Chapter: 3
HOUSEHOLD COMPOSITION

3.1 The analysis of household composition in the farming systems survey is to set production and management information in a social context and to establish labour availability. New demographic data are becoming available from the 1986 census and these provide background to survey results. Table 3.1 summarises some early results of the census[1].

Table: 3.1
POPULATION CHARACTERISTICS
(from the 1986 census)

Province	Western	Ysabel	Central	Guadal	Honiara	Malaita	Makira	Temotu	Total
1986 population	55,250	14,616	18,457	49,831	30,413	80,032	21,796	14,781	285,176
annual growth rate	3.0	3.2	2.9	4.3	6.8	2.7	3.6	2.8	3.5
% national population	19	5	6	17	11	28	8	5	100
peri-urban population	3,710	1,901	1,622		30,413	3,252	2,588	1,295	44,781
% peri-urban	7	13	9	38		4	12	9	16
males	29,202	7,329	9,850	26,251	17,293	39,605	11,174	7,268	147,972
females	26,048	7,287	8,607	23,580	13,120	40,427	10,622	7,513	137,204
sex-ratio	112	101	114	111	132	98	105	97	108
number of households	7,942	2,362	3,079	8,072	4,317	12,417	3,278	2,375	43,842
household size	6.96	6.19	5.99	6.17	7.04	6.45	6.65	6.22	6.50
Age composition (%)									
0 - 14	46.4	48.8	45.7	46.8	39.2	50.2	50.7	49.6	47.3
15 - 29	27.2	22	26	27.2	35.7	21.7	23.3	23.3	25.8
30 - 44	13.5	13.9	14.4	14	17.1	13.2	13.1	13.3	13.9
45 - 59	8	8.5	8.2	7.3	5.8	9.1	8.2	8.5	8.1
60 +	4.9	6.7	5.7	4.6	2.1	5.7	4.6	5.5	4.9

Source: Statistics Office Statistical Bulletin 3/88

3.2 In November 1986 the population of Solomon Islands was **285,176** with an annual growth rate of **3.5%**. The national mean household size was **6.5**, resulting in a total of **43,842** households, of which at least **84%** are rural. Guadalcanal, Malaita and Western Provinces account for **77%** of the national population.

3.3 The age composition of the Solomon Islands population is young with a wide based, tapering population pyramid. The "dependency ratio" (the number of persons under 15 years and over 60 years of age per 100 persons aged 15 to 59 years) is 109[2].

3.4 The total fertility rate is 6.4 children per woman at the end of her child bearing age. The life expectancy at birth among males is 59.9 years, and among females is 61.4 years. Male infant mortality is 40 per thousand live births compared with a female infant mortality of 36 per thousand live births[2].

3.5 In the census 40,046 persons attended school during 1986, although some disruption was caused by Cyclone Namu. Among all persons aged 5 years and over not attending school in 1986, 51% had no education. Primary school attendance spans a wide age range, but 20% of age group 10 to 24 never attended school.

3.6 94.2% of the Solomon Islands population is Melanesian, 3.7% Polynesian and 2.1% other ethnic groups, but mainly Kiribati. 17% of the census population were residing in a province other than that of their birth, indicating a considerable level of internal migration. Onward movement is particularly strong from Malaita, resulting in net out-movement. This is true for provinces other than Central and Guadalcanal which experience a net in-movement. All provinces showed a net movement to Honiara.

3.7 Household composition results from the farming systems survey are summarised in table 3.2. Age categories are chosen to provide approximate conversion into "available labour units". The membership of a household often includes relatives and, less commonly, non-relatives (these are both referred to as "relatives" in the table). Both family and non-family members define the "de facto" household size which is the actual number of people residing in the household, and is illustrated in diagram 3.1. A second measure of household composition is the number of immediate family members (father, mother, sons and daughters) either living at home or living away. This is known as the "de jure" family size.

Table: 3.2
HOUSEHOLD COMPOSITION
(from the farming systems survey)

Mean Number of Household Members:

MALE						FEMALE				
living at HOME			AWAY	AGE GROUP		living at HOME			AWAY	
Head	Family	Relative	Family			Head	Family	Relative	Family	
0.13				> 55		0.05				
0.87	0.72	0.03	0.25	16 - 55		1.58	0.05		0.20	
	1.13	0.03		6 - 15		0.78	0.03			
	0.57			2 - 5		0.57	0.03		0.05	
	0.10			0 - 1		0.08	0.03			total
Category total:	1.00	2.52	0.06	0.25		3.06	0.14	0.25		7.28
Family at home:		3.52				3.06				6.58
De Facto total:			3.58				3.20			6.78
De Jure total :				3.77				3.31		7.08

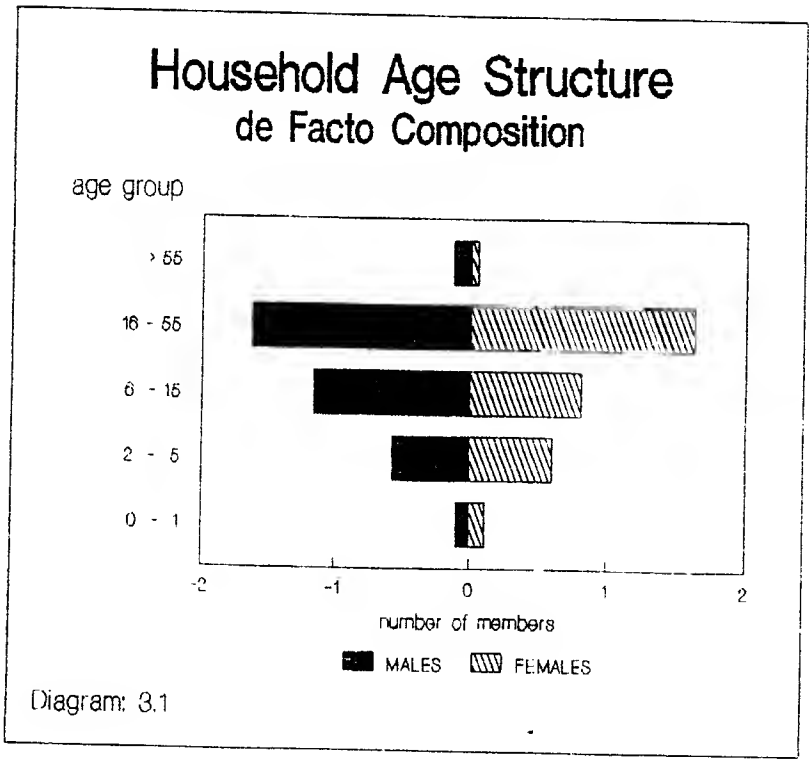


Diagram: 3.1

3.8 In the survey area the average family size is 7.08. With 7% of family members living away from home, a household has on average 6.78 members, of which 6.58 are immediate family and the remainder relatives or others residing in the household. Those living away are mostly in the economically active age group 16 - 55. Of 3.77 male family members 3.52 live at home, representing a net onward movement of 7% among male family members. This is not entirely compensated for by non-family male household members, since there are only 3.58 males in the household.

3.9 Of 3.31 female family members 3.06 live at home, representing an onward movement of 8% . Again this is not entirely compensated for by additional non-family female members living in the household since there are 3.20 female members of the household.

3.10 There is then a 5% net out movement of males and a 3% net outward movement of females, predominantly in the economically active age group. This results in a household gender composition of 3.58 male household members to 3.20 females, a ratio of 1:0.89 males to females.

3.11 Household composition is converted into "adult equivalent labour units" in table 3.3 according to factors employed by Bathgate[18] (although there are slight differences in age classes between the two studies). An average household of 3.95 labour units is made up of 2.05 male units and 1.90 female units. Men account for 52% of household available labour and women 48%.

Table: 3.3
HOUSEHOLD LABOUR AVAILABILITY

Mean number of members by age group:

MALES de Jure	MALES de Facto	MALES labour	AGE GROUP	FEMALES de Jure	FEMALES de Facto	FEMALES labour	TOTAL de Jure	TOTAL de Facto	TOTAL labour
0.13	0.13	0.07	> 55	0.05	0.05	0.03	0.18	0.18	0.10
1.84	1.62	1.63	16 - 55	1.78	1.63	1.63	3.62	3.25	3.26
1.13	1.16	0.35	6 - 15	0.78	0.81	0.24	1.91	1.97	0.59
0.57	0.57		2 - 5	0.62	0.60		1.19	1.17	
0.10	0.10		0 - 1	0.08	0.11		0.18	0.21	
Total	3.77	3.58	2.05	3.31	3.20	1.90	7.08	6.78	3.95

Labour availability assumes the following conversion factors:

age class	factor
> 55	0.6
16 - 55	1.0
6 - 15	0.3
0 - 5	0.0

Chapter: 4
INCOME EARNING ACTIVITIES

4.1 2.5% of rural households in the country were enumerated in the 1982 Household Income and Expenditure Survey [3] conducted by the Statistics Office of the Ministry of Finance. Virtually all rural households had food gardens. **39%** sold copra and **41%** sold garden produce, with an average monthly income from sales of SI$ 56. A summary of income earning activities according to the 1982 survey compared with the 1986 population census is presented in table 4.1.

Table: 4.1
1982 INCOME AND EXPENDITURE SURVEY: SALES

activity	% households earning income	
	1982	1986
copra	39	29
coconut	18	
cocoa	0.38	9
betel nut	1.25	17
other cash crop	12	
garden produce	41	34
cattle		2
pigs		12
poultry		10
fish	24	17
crabs, lobster		4
beche de mer		12
shells	7	
carvings	4	
hand crafts	0.38	4
canoes		3
mats, baskets		10
thatch		4
houses		5
other sales	1.13	

Source: Statistics Office Natioanl Accounts Discussion Document No 2
Statistics Office Bulletin 12/88

4.2 These figures show the importance of garden produce sales as an income earning activity, although the relative magnitude of earnings is not known. Copra is the major cash earning commodity, showing an apparent contraction in the proportion of rural sales. By contrast cocoa sales have expanded.

4.3 In the 1982 survey **27%** of rural households had at least one member in paid employment, from which the average monthly wage was **SI$103. 16%** had their own business and **39%** of households had a share in a cooperative (although it is stated that this result should be treated with caution). **10%** of households held a loan, with an average monthly repayment of **SI$87**, the majority with the Development Bank of Solomon Islands.

4.4 On average a household spent **SI$57** per month on goods and services of which **47%**, or **SI$27**, was on food. Less frequent expenditures amounted to **SI$5** per month.

4.5 Reported (cash and non-cash) income was **SI$147** compared to monthly expenditures of **SI$131**. The average cash component of income amounted to **SI$86** per month compared with expenditures of **SI$74**. The excess of **17%** in income over expenditure was believed to be due to the underestimation of production costs rather than the true value of rural savings.

4.6 The 1986 census [2] found that **25%** of the population aged 14 years and over was working for money (the week before the census enumeration), and about half of those also performed village work such as track clearing and church construction. About **80%** of those not engaged in cash employment performed village work.

4.7 **35%** of males were engaged in cash employment compared with **13%** of females. The 1982 Household Income and expenditure survey also states that "generally boys had a better chance of attending school than girls".

4.8 The rural economy is diverse, with a variety of farm and off-farm activities which contribute to household income. Results from the farming systems survey are presented in table 4.2. The table describes the proportion of households undertaking income earning activities in the survey area. Rural income and expenditure patterns are covered by other (non AES) surveys - planned or recently undertaken - and so the present survey does not investigate the relative importance of activities undertaken in terms of income earned, except in Chapter 19 on marketing.

Table: 4.2

INCOME EARNING ACTIVITIES

	⟨---- % households ----⟩ by activity individual	group	summary of individual activities
Households Earning Income Over the Past Year From:			
COCONUTS			
Coconuts	5	8	++
Copra	5	8	++
Coconuts and Copra	3		+
Total	13		
COCOA			
Wet beans	18	18	++++++++
Dry Beans			
Wet and Dry Beans			
Total	18		
OTHER CROPS			
Food Crops	53	55	++++++++++++++++++++++++++
Other Cash Crops	3	3	+
Food and Cash Crops			
Livestock		3	
Food crops and Livestock	3		+
Cash Crops and Livestock			
Food, Cash Crops and Livesock			
Total	58		
FISHING			
Fish	10	10	+++++
Shellfish			
Fish and shellfish			
Crabs, etc			
Fish and Crabs			
Shellfish and Crabs			
Fish, Shellfish and Crabs			
Total	10		
LOGGING/MINING			
Logging	15	15	+++++++
Sawmill			
Logging and Sawmill			
Mining			
Logging and Mining			
Sawmill and Mining			
Logging, Sawmill and Mining ..			
Total	15		

INCOME EARNING ACTIVITIES (continued)

	⟨---- % households by activity ----⟩ individual	group	summary of individual activities
PROFESSION			
Teacher			
Government Employee	18	18	++++++++
Other Profession	38	38	++++++++++++++++++
Total	55		
COOPERATIVE			
Crop Production Cooperative ..			
Marketing Cooperative			
Crop and Marketing			
Cooperative Shop	3	3	+
Crop and Shop			
Marketing and Shop			
Crop, Marketing and Shop			
Total	3		
BUSINESS			
Private shop	5	5	++
Vehicle Hire			
Shop and Vehicle			
Crafts			
Shop and Crafts			
Vehicle and Crafts			
Shop, Vehicle and Crafts			
Total	5		
SKILLED TRADE			
Joiner/housebuilder			
Mechanical Trade	5	5	++
Joiner and Mechanical			
Other Skilled Trade	3	3	+
Joiner and Other			
Mechanical and Other			
Joiner, Mechanical and Other .			
Total	8		

4.9 In the table are two columns, entitled "individual" and "group". Individual activities distinguish between combinations of activities - treating for instance "food crops" (only), "livestock" (only) and both "food crops and livestock" as three distinct activities. The percentages of households for individual activities are additive, and are shown as a "total" for each set of related activities in the table.

4.10 Under group activities - all occurrences of "food crops" and all occurrences of "livestock" are summarised under the two main headings, since "livestock" and "food crops and livestock" are both livestock activities. "Group" activities represent an alternative summary for the data set, and are non additive.

4.11 To the right of table 4.2 is a histogram summary of individual activities. Diagram 4.1 provides a visual summary of grouped activities.

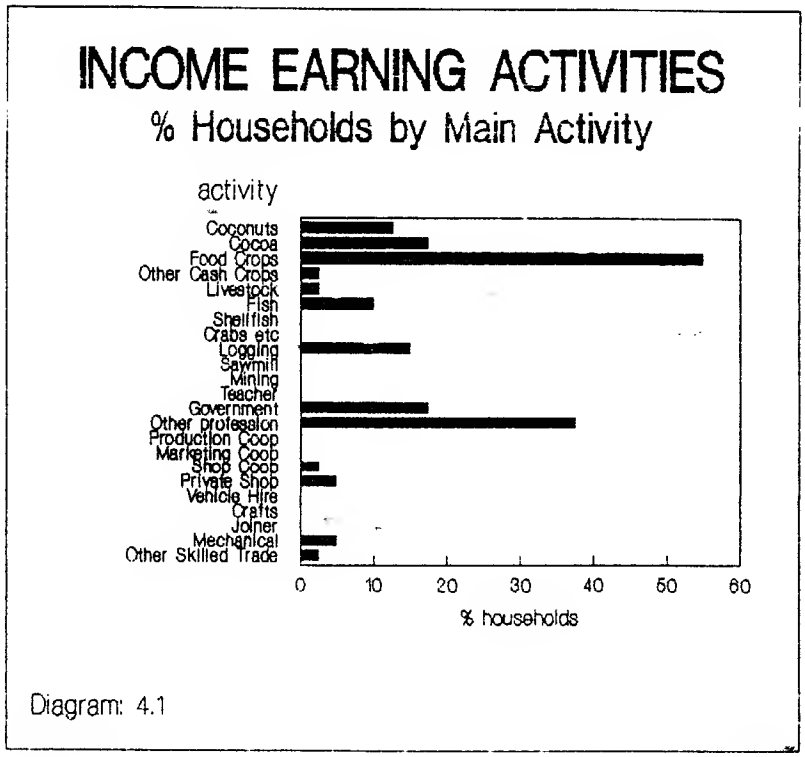


Diagram: 4.1

4.12 The dominant income earning activities in the survey area are the sale of food crops, undertaken by 55% of households and professional trades also undertaken by 55% of households. These figures indicate the urban influence in the survey area, where 18% of surveyed farmers are government employees.

4.13 15% of sampled households earned income from logging, which is an important economic activity in the survey area.

4.14 Other activities are relatively minor. While 18% of households earned income from cocoa sales (in the form of green beans), only 8% earned income from copra.

4.15 Other income earning activities include fishing, cooperative and private shops, and skilled trades.

Chapter: 5
EXTENSION AND MASS MEDIA

5.1 Table 5.1 summarises the penetration of mass media and extension in the survey area.

Table: 5.1
EXTENSION AND MASS MEDIA

	% households	summary
i) Households Listening to Agricultural Programmes on the Radio:		
Never listen	58	+++++++++++++++
Listen weekly	5	+
" monthly	25	++++++
" occasionally	13	+++
Total	100	
ii) Households with Members who can Read and Write:		
Not able to read or write	15	+++
Able to read		
" write		
" read and write	85	++++++++++++++++++++
	100	
iii) Households Visited by (any type of) Extension Worker:		
Never been visited	68	++++++++++++++++
Visited very occasionally	5	+
" once per year	8	+
" " " 6 months	5	+
" " " 3 months	3	.
" " " month		
" " " week	3	.
Don't know	10	++
	100	
iv) Households in which Members have Attended Training:		
Never attended training	88	++++++++++++++++++++
Attended village meeting	3	.
" day course at training centre		
" village meeting and day course		
" residential course	10	++
" village meeting and residential course		
" day and residential course		
" village meeting, day and residential course		
	100	

5.2 Travel and communication are difficult in Solomon Islands, with scattered islands of low population densities. Radio offers a means of transmitting information throughout the country, albeit one-way, and in a medium which makes few demands on literacy. In the survey only 30% of households regularly listen to agricultural programmes on the radio, either weekly or monthly. 3% listen occasionally but 58% never listen to agricultural programmes. With 42% of households listening to agricultural programmes the communication of agricultural and other development information may be extended by word of mouth.

5.3 The second part of the table shows the proportion of households in which at least one member is able to read or write. According to these results 85% of households have at least one member with some reading and writing skills. The survey was unable to verify the level of skills or to substantiate this finding objectively, but the result suggests that simple written materials are an appropriate extension medium. In more general terms, pictural materials would be popular together with simple text and annotation.

5.4 The frequency of extension visits is investigated in the third part of the table, and is illustrated in diagram 5.1.

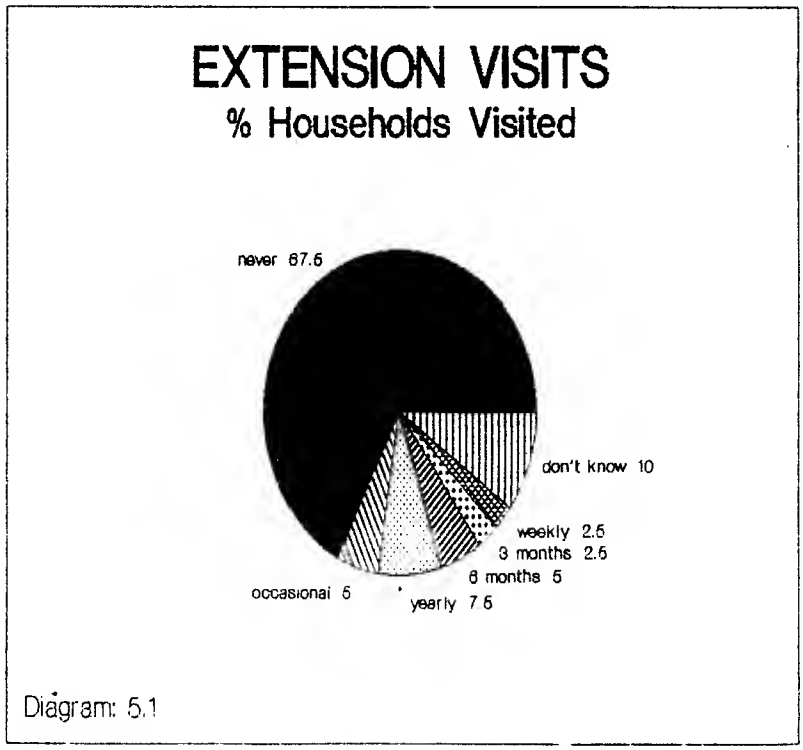


Diagram: 5.1

5.5 Extension in the present study refers to any agricultural worker in government extension, research, NGOs or other organisations. **11%** of households are visited regularly at least twice per year, with **3%** visited monthly or weekly. **68%** of households have never been visited by any type of extension worker.

5.6 These results again reflect the urban influence, and relative lack of importance of agriculture, in the economy of the survey area. **88%** of households have never participated in any form of agricultural training while **10%** have attended a residential course.

Chapter: 6
LIVESTOCK

6.1 Livestock, particularly small stock such as pigs and chickens, are an important feature of smallholder agriculture in Solomon Islands.

6.2 The number of cattle in the 1985 census was 19,750 - a fall of 13.1% from 1984 due largely to destocking in the plantation sector. Overall the national herd was 22% below its peak of 1978, with an average annual fall of 3.4%[4].

6.3 The smallholder sector accounted for 7,612 cattle, 39% of the national herd, showing a decline of 4.1% from the 1984 census. The distribution of cattle throughout the country is shown in table 6.1.

Table: 6.1
CATTLE DISTRIBUTION IN 1985

Province	total cattle	% distribution
Western	4,841	25
Ysabel	1,110	6
Central	2,081	10
Guadalcanal	6,292	32
Malaita	3,810	19
Makira	1,462	7
Temotu	217	1
Total	19,750	100

Source: Statistics Office, 1985 Cattle Census

6.4 In the 1982 Income and Expenditure Survey[3] it was found that 37% of households owned pigs, 30% owned chickens, but only 8% owned cattle. The provincial breakdown is shown in table 6.2.

6.5 According to the 1986 Population Census[2] 2% of households earned income from cattle, 12% earned income from pigs and 10% earned income from poultry.

Table: 6.2
LIVESTOCK DISTRIBUTION IN 1982

Province	% households owning		
	cattle	pigs	chickens
Western	2	19	24
Ysabel	42	25	47
Central		28	7
Guadalcanal	2	63	41
Malaita	9	35	28
Makira	10	69	63
Temotu		40	4
Total	8	37	30

Source: Statistics Office, 1982 HH Income and Expenditure Survey

6.6 In the present survey 3% of households earned income from livestock (table 4.2).

6.7 Table 6.3 summarises livestock ownership in the survey area, and is divided into three columns. The first, entitled "ownership %", specifies the percentage of households which own livestock. The middle two columns show mean stock held: firstly among livestock owning households (owners); and secondly as an average of all farmers in the survey area (both owners and non-owners). To the right of the table is a histogram summary of ownership based on the mean among all farmers.

6.8 The table is divided horizontally into three main parts. The first part specifies stock numbers kept predominantly for home use, but which may include occasional sales. The second part specifies stock numbers where livestock comprise an income earning enterprise. The third part is the overall mean of livestock ownership irrespective of type of enterprise. (Note that overall mean ownership figures are derived from the original data and may not be obtained from summation of the table entries above).

6.9 At the foot of the table is a component on novel livestock enterprises, such as bees, butterflies and crocodile farming, however, these were not encountered in the survey.

Table: 6.3
LIVESTOCK

Livestock Ownership:

	ownership %	(-- mean ownership among owners	-- mean ownership among all farmers	summary all farmers
i) Home Use				
Cattle	3	8.00	0.20	.
Pigs	65	3.85	2.50	++++++++++
Goats				
Chickens	63	12.48	7.80	++++++++++++++++++++++++++++++++
Ducks				
Horses				
ii) Commercial				
Cattle	5	6.50	0.32	+
Pigs				
Goats				
Chickens	3	37.00	0.93	+++
Ducks				
Horses				
iii) Total				
Cattle	8	7.00	0.52	++
Pigs	65	3.85	2.50	++++++++++
Goats				
Chickens	65	13.42	8.73	++++++++++++++++++++++++++++++++++
Ducks				
Horses				

iv) Households Earning Income	(---- % households by activity individual	group
Income from:		
1. Bees or honey		
2. Butterflies		
3. Bees and Butterflies		
4. Crocodiles		
5. Bees and crocodiles		
6. Butterflies and crocodiles		
7. Bees, butterflies and crocodiles		

6.10 8% farmers own cattle with a mean herd size of 7.00 head. Two farmers, with a mean herd size of 6.5, keep cattle commercially and one farmer with 8 head regards cattle as essentially for home use. Cattle are kept in part for marriage feasts and other celebrations. Stock are fattened for sale to the Livestock Development Authority, although bush killings are practiced. Cattle are generally managed by the men of the household who will inspect the stock regularly and check fences.

6.11 Pigs play an important role in the custom and life of rural households. They are kept mainly for ceremonial feasts, weddings and other social gatherings. Pigs may be sold, often to buy shell money or for cash.

6.12 In the survey area 65% of farmers keep pigs with a mean herd size of 3.85 among owners.

6.13 Pigs are commonly kept in fenced enclosures made of wood or stone with a sago palm shelter, but pigs cause damage to gardens when fences are not maintained. Penning in this way requires that the owners feed and water the pigs in the morning and again in the evening, and clean out the pens. Generally the women of the household look after the pigs, which are fed on scraps, sweet potato, cassava, banana and sago.

6.14 Pigs are generally kept fairly close to the household and the time spent in tending pigs is relatively minor in relation to garden work.

6.15 Chickens are also important in the traditions and lives of local people, particularly at Christmas and other special gatherings, and are often given as gifts to relatives. They are largely kept for food but also earn income for the family through sales.

6.16 Chickens are kept by 65% of households with a mean flock size of 13.42 among owners. One farmer, or 3% of sampled farmers, keeps chickens commercially with a flock size of 37.

6.17 Chickens are generally allowed to range free and require little or no management.

Chapter: 7
HOLDING SIZE DISTRIBUTION

7.1 Holding size distribution is of interest because it provides an understanding of the structure of agriculture and may help to explain constraints faced by farmers or response to services.

7.2 Table 7.1.i describes the holding size distribution of the survey area. Two sampled households are not included in the analysis as they have no cropped land and so the sample size has dropped to 38. Of those remaining, holdings are not spread normally about the mean of .832ha but are skewed, in that many farmers have very small holdings while a few have comparitively large holdings. As a result **58%** of farmers have holdings less than **0.5ha**. This can be seen in diagram 7.1 which shows that the majority of farmers fall in the low holding size classes.

7.3 The mean describes the "average" holding size and is of interest in that it provides a value for the "middle" of the data based on the spread of values, but it may be misleading when unbalanced extreme values occur. Another measure of central tendency is the median which is the "mid-point" in the data, the value of the middle item when the data are arranged in order. In a "normal distribution" the median and the mean coincide. The median in this case is **0.327ha** indicating that skewness in the holding size distribution needs to be taken into account when considering the mean holding of 0.832ha.

7.4 An indicator of variability is the range, which is derived from extremes in the data. The minimum area is **0.029ha** and the maximum is **5.665ha**, a range of **5.636ha**. Holding sizes are fairly widely spread and the mean falls towards the lower end of the range.

7.5 The standard deviation is a measure of variation based on the extent to which values deviate from the mean. If the data are closely bunched the standard deviation is small, and if they are widely spread it is large. In a normal distribution 68% of values lie within 1 standard deviation on either side of the mean, and 95% within 2 standard deviations. In the survey results the mean of **0.832ha** has a standard deviation of **1.231** and a coefficient of variation of **148%** (the standard deviation expressed as a percentage of the mean).

7.6 Skewness is an index of symmetry in the data. A normal

7.6 Skewness is an index of symmetry in the data. A normal distribution is symmetrical about the mean, with a skewness coefficient of zero, whereas a skewed distribution has a longer "tail" on one side than the other. The present data have a skewness of 2.931 indicating moderately positive skewness.

7.7 Kurtosis is the extent to which the data cluster around a central point. When this occurs the distribution appears "peaked", as in the present data set, which is said to be "leptokurtic". Positive values of kurtosis indicate that the distribution is more peaked than normal. In the present data set the coefficient of kurtosis is 9.152.

7.8 The indications are that there is inequality in holding size distribution, which may be viewed in standard form in diagram 7.2. The diagonal represents the holding size distribution for equality and the curve below represents the actual (cumulative) holding size distribution. The area between the diagonal and the curve is the "area of inequality". The larger the area of inequality, the more unequal the holding size distribution. This may be expressed as an index, called the "Gini coefficient", which is the area between the two lines expressed as a proportion of the area of the triangle below the diagonal. The Gini coefficient ranges from 0 (for perfect equality) to 1 (for perfect inequality). The Gini coefficient here is 0.6, indicating considerable inequality.

Table: 7.1

HOLDING SIZE DISTRIBUTION

i) All holdings and all crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	(------- % --------) holdings	area	(-- cumulative % --) holdings	area
0 - .25	14	0.1306	1.83	37	6	37	6
.25 - .5	8	0.3096	2.48	21	8	58	14
.5 - .75	3	0.6352	1.91	8	6	66	20
.75 - 1	2	0.8990	1.80	5	6	71	25
1 - 1.25	5	1.0849	5.42	13	17	84	42
1.25 - 1.5						84	42
1.5 - 1.75	2	1.5994	3.20	5	10	89	53
1.75 - 2	1	1.7556	1.76	3	6	92	58
2 - 2.5	1	2.4432	2.44	3	8	95	66
2.5 - 3						95	66
3 - 5						95	66
5 - 10	2	5.3938	10.79	5	34	100	100
10 - highest						100	100
Total	38	0.8321	31.62	100	100		

Mean	0.832	S.E. Mean	0.200
Median	0.327	Coef. of Var %	148
Std Dev	1.231	Variance	1.516
Kurtosis	9.152	S.E. Kurtosis	0.750
Skewness	2.931	S.E. Skewness	0.383
Range	5.636	Minimum	0.029
Maximum	5.665	Sum	31.619
Gini	0.600		

Note that the main table is a frequency distribution of grouped intervals, while the statistics at the foot of the table describe the ungrouped data set.

HOLDING SIZE DISTRIBUTION

all holdings - all crops

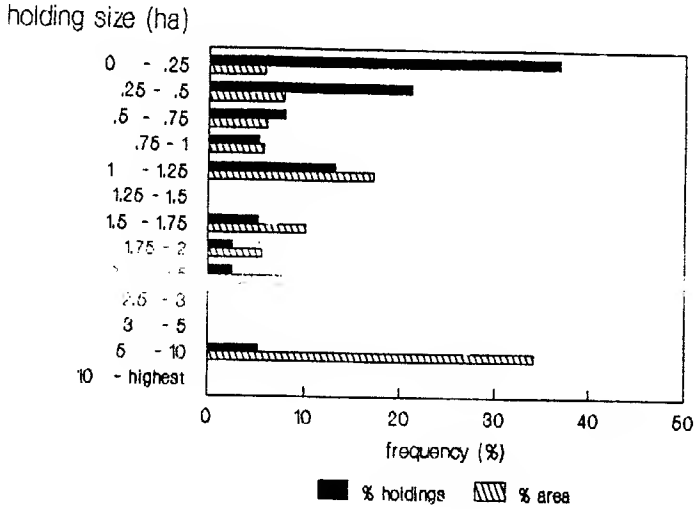


Diagram: 7.1

LORENZ CURVE

all holdings - all crops

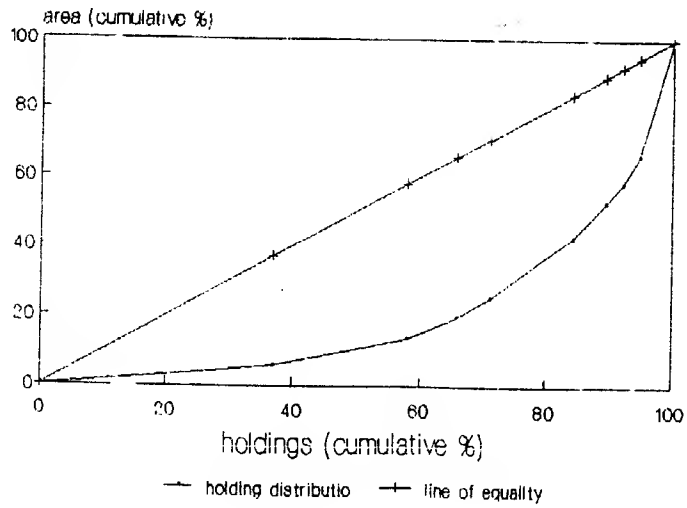


Diagram: 7.2

7.9 Table 8.1.ii shows the holding size distribution of only those farmers who have tree crops. The sample is reduced from 38 to 18, and so the stratum of farmers with tree crops represents **47%** of all farmers in the sample.

7.10 The mean holding size among tree cropping farmers is 1.553ha and the median is **1.024ha**. The coefficient of skewness has dropped slightly to **2.141** and kurtosis has fallen to **4.012**. The range remains wide, but the distribution is less scattered, with a coefficient of variation of **96%**.

ii) Holdings with tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	<------- % --------> holdings	area	<-- cumulative % --> holdings	area
0 - .25							
.25 - .5	2	0.3213	0.64	11	2	11	2
.5 - .75	3	0.6352	1.91	17	7	28	9
.75 - 1	2	0.8990	1.80	11	6	39	16
1 - 1.25	5	1.0849	5.42	28	19	67	35
1.25 - 1.5						67	35
1.5 - 1.75	2	1.5994	3.20	11	11	78	46
1.75 - 2	1	1.7556	1.76	6	6	83	53
2 - 2.5	1	2.4432	2.44	6	9	89	61
2.5 - 3						89	61
3 - 5						89	61
5 - 10	2	5.3938	10.79	11	39	100	100
10 - highest						100	100
Total	18	1.5531	27.96	100	100		

Mean	1.553	S.E. Mean	0.353
Median	1.024	Coef. of Var %	96
Std Dev	1.497	Variance	2.240
Kurtosis	4.012	S.E. Kurtosis	1.038
Skewness	2.141	S.E. Skewness	0.536
Range	5.379	Minimum	0.286
Maximum	5.665	Sum	27.956
Gini	0.423		

7.11 The new distribution of farmers with tree crops is illustrated in diagram 7.3, and its associated Lorenz curve in diagram 7.4. Inequalities have been reduced since the majority of small farmers are excluded, with a resultant rise in mean and median holding size; a drop in variability; and greater equality among tree cropping farmers. The holding size distribution is more "normal", although there remain extremes, with a Gini coefficient of **0.423**.

HOLDING SIZE DISTRIBUTION

holdings with tree crops

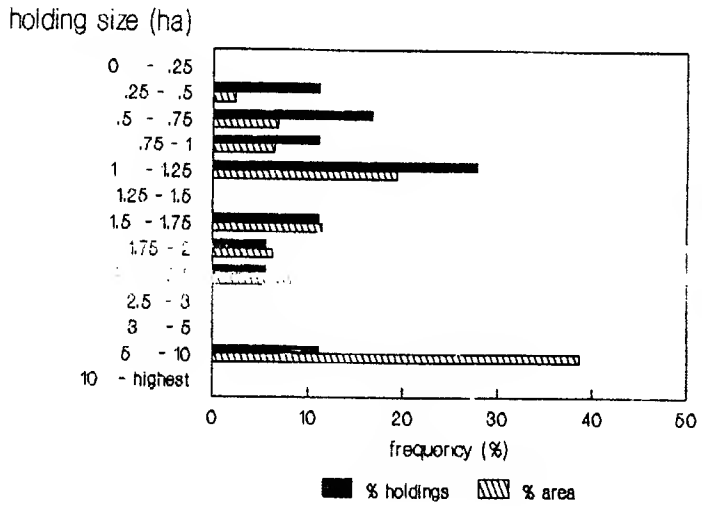


Diagram: 7.3

LORENZ CURVE

holdings with tree crops

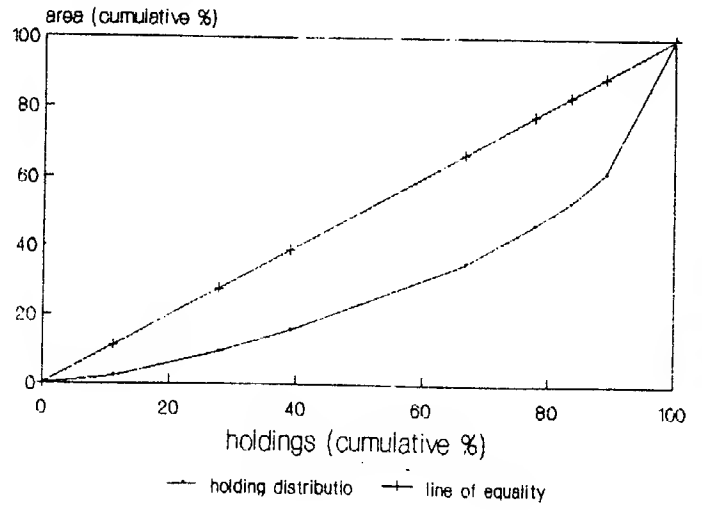


Diagram: 7.4

7.12 The corresponding stratum of farmers with no tree crops is shown in table 7.1.iii. 20 farmers, or **53%** of the sample have no tree crops. The mean holding size is **0.183ha** and the median is **0.191a**. The range is small, skewness has dropped to **0.162** and kurtosis is slightly negative. The distribution is again more "normal", with a coefficient of variation of **58%**.

7.13 The holding size distribution is illustrated in diagram 7.5, and its associated Lorenz curve in diagram 7.6. Inequality is low with a Gini coefficient of **0.304**.

iii) Holdings without tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	⟨------- % --------⟩ holdings	area	⟨-- cumulative % --⟩ holdings	area
0 - .1	6	0.0610	0.37	30	10	30	10
.1 - .2	5	0.1521	0.76	25	21	55	31
.2 - .3	6	0.2489	1.49	30	41	85	72
.3 - .4	3	0.3477	1.04	15	28	100	100
.4 - .5						100	100
.5 - .6						100	100
.6 - .7						100	100
.7 - .8						100	100
.8 - .9						100	100
.9 - 1						100	100
1 - 1.5						100	100
1.5 - 2						100	100
2 - highest						100	100
Total	20	0.1832	3.66	100	100		

Mean	0.183	S.E. Mean	0.024
Median	0.191	Coef. of Var %	58
Std Dev	0.107	Variance	0.011
Kurtosis	-0.977	S.E. Kurtosis	0.992
Skewness	0.162	S.E. Skewness	0.512
Range	0.360	Minimum	0.029
Maximum	0.389	Sum	3.663
Gini	0.304		

Note the smaller size classes in this table with respect to previous tables.

HOLDING SIZE DISTRIBUTION

holdings without tree crops

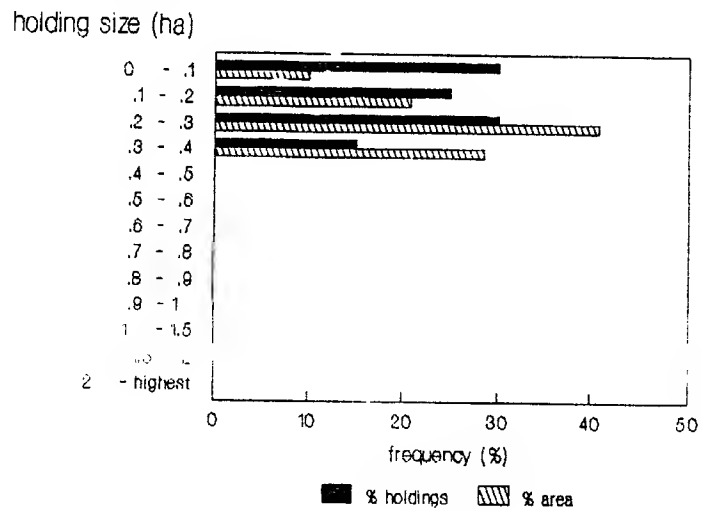


Diagram: 7.5

LORENZ CURVE

holdings without tree crops

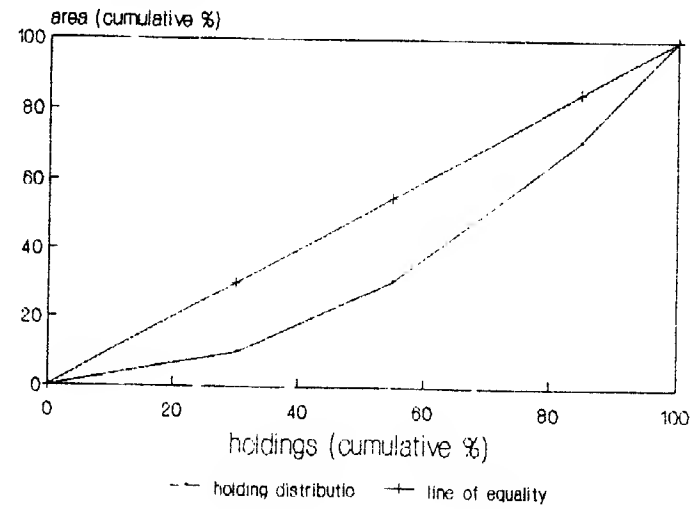


Diagram: 7.6

7.14 Table 7.1.iv describes the holding size distribution of all farmers, but excluding tree crop areas. The holding size distribution is illustrated in diagrams 7.7 and 7.8. These results are similar to those for non-tree crop farmers, indicating that subsistence cropping is similar among all farmers with a mean area of **0.251ha.**

iv) All holdings - total area excluding tree crops

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	⟨------- % --------⟩ holdings	area	⟨-- cumulative % --⟩ holdings	area
0 - .1	8	0.0542	0.43	21	5	21	5
.1 - .2	11	0.1517	1.67	29	18	50	22
.2 - .3	7	0.2679	1.87	18	19	68	40
.3 - .4	5	0.3566	1.78	13	19	82	59
.4 - .5	3	0.4189	1.26	8	13	89	72
.5 - .6	1	0.5229	0.52	3	5	92	78
.6 - .7	2	0.6795	1.36	5	14	97	92
.7 - .8	1	0.7653	0.77	3	8	100	100
.8 - .9						100	100
.9 - 1						100	100
1 - 1.5						100	100
1.5 - 2						100	100
2 - highest						100	100
Total	38	0.2506	9.52	100	100		

Mean	0.251	S.E. Mean	0.030
Median	0.213	Coef. of Var %	75
Std Dev	0.187	Variance	0.035
Kurtosis	0.958	S.E. Kurtosis	0.750
Skewness	1.123	S.E. Skewness	0.383
Range	0.736	Minimum	0.029
Maximum	0.765	Sum	9.525
Gini	0.385		

HOLDING SIZE DISTRIBUTION

all holdings excluding tree crops

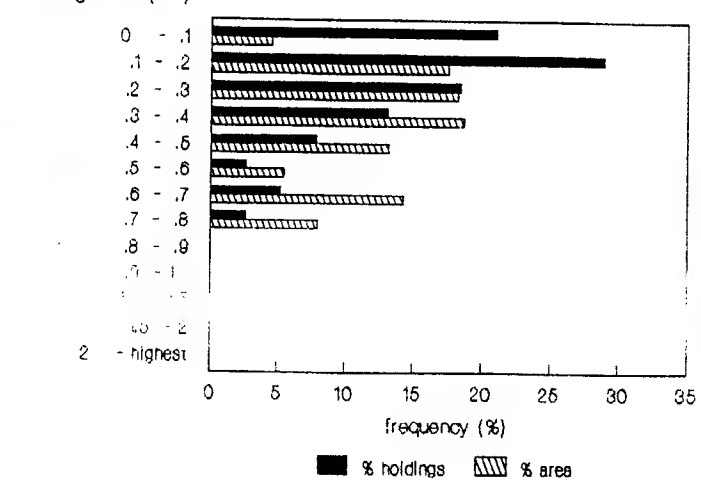


Diagram: 7.7

LORENZ CURVE

all holdings excluding tree crops

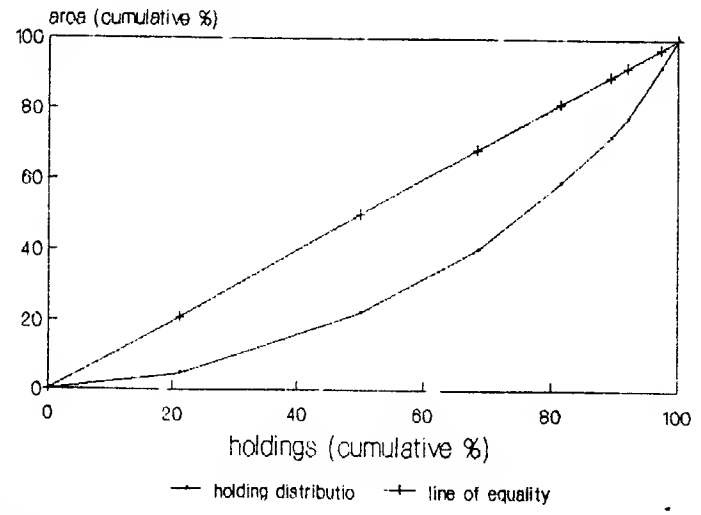


Diagram: 7.8

7.15 Table 7.1.v describes the size distribution of tree crop areas, illustrated in diagrams 7.9 and 7.10.

v) All holdings - total area of tree crops only

holding size (ha)	number of holdings	mean area in class (ha)	total area in size class (ha)	% holdings	% area	cumulative % holdings	cumulative % area
0 - .25	3	0.1531	0.46	17	2	17	2
.25 - .5	4	0.4070	1.63	22	7	39	9
.5 - .75	2	0.6071	1.21	11	5	50	15
.75 - 1	4	0.9356	3.74	22	17	72	32
1 - 1.25						72	32
1.25 - 1.5	1	1.5000	1.50	6	7	78	39
1.5 - 1.75	1	1.5353	1.54	6	7	83	46
1.75 - 2						83	46
2 - 2.5	1	2.3320	2.33	6	11	89	56
2.5 - 3						89	56
3 - 5	1	4.4517	4.45	6	20	94	76
5 - 10	1	5.2307	5.23	6	24	100	100
10 - highest						100	100
Total	18	1.2274	22.09	100	100		

Mean	1.227	S.E. Mean	0.339
Median	0.680	Coef. of Var %	117
Std Dev	1.438	Variance	2.069
Kurtosis	3.688	S.E. Kurtosis	1.038
Skewness	2.054	S.E. Skewness	0.536
Range	5.138	Minimum	0.093
Maximum	5.231	Sum	22.094
Gini	0.526		

Note that the size classes are the same as for tables i and ii.

7.16 Indicators of variability are again high confirming that a large proportion of holding size inequality among smallholder farmers can be explained by tree cropping. The subsistence component of holdings is relatively uniform, while considerable variability is seen in the area under tree crops.

HOLDING SIZE DISTRIBUTION

all holdings - tree crops only

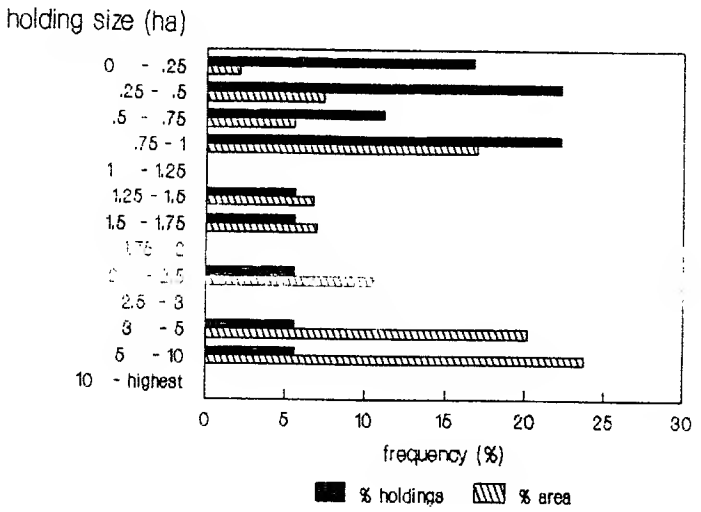


Diagram: 7.9

LORENZ CURVE

all holdings - tree crops only

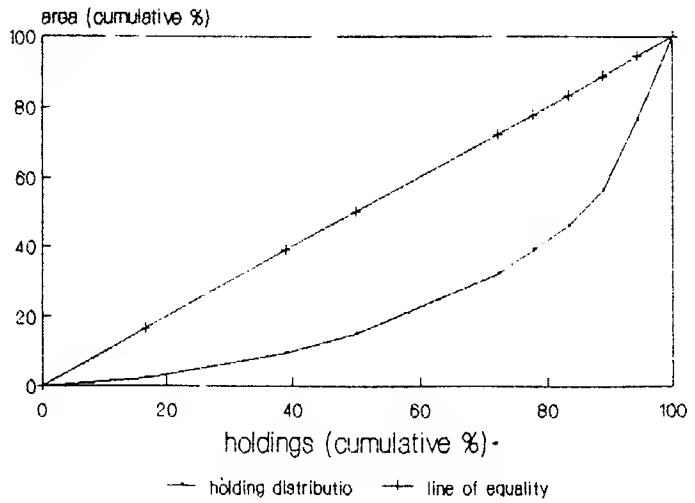


Diagram: 7.10

Chapter: 8
LABOUR DENSITY

8.1 According to Bathgate[18] "increments in the population of a household do not result in an expansion in the garden area. Instead, the garden area holds constant and ... the actual area per consumption and labour unit decreases ... Although there is a variation ... the average household ... tends to clear a fairly similar amount of land for gardens and plant a similar area of root crops". Bathgate postulates that there is no relationship between household size and food garden area. Larger family sizes are not then associated with larger holdings, and he attributes this to a tendency among subsistence producers to cultivate in excess of household requirements as insurance against crop failure.

8.2 In the present survey the area of food crops is found to be relatively constant in comparison to a variabile tree crop area. Table 8.1 shows the relationship between holding size and labour availability.

Table: 8.1
LABOUR DENSITY - ALL HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	4.03	0.83	4.84	38
< .25	2.78	0.13	21.28	14
.25 - .5	4.54	0.31	14.66	8
.5 - .75	4.50	0.64	7.08	3
.75 - 1	2.90	0.90	3.23	2
1 - 1.25	4.40	1.08	4.06	5
1.25 - 1.5				
1.5 - 1.75	3.00	1.60	1.88	2
1.75 - 2	8.00	1.76	4.56	1
2 - 2.5	5.20	2.44	2.13	1
2.5 - 3				
3 - 5				
5 - 10	8.65	5.39	1.60	2
> 10				

8.3 There is a weak relationship in that larger holdings tend to have more available labour. Results are, however, in agreement with Bathgate's findings since labour density falls rapidly from 21.28 adult units per hectare for the smallest holding class (less than 0.25ha) to 1.60 units in the largest (5-10ha) class. Small holdings then have a high labour density while large holdings have a low labour density, as seen in diagram 8.1.

8.4 Labour densities are high overall and with a mean of 4.84 labour units per hectare labour is unlikely to be limiting.

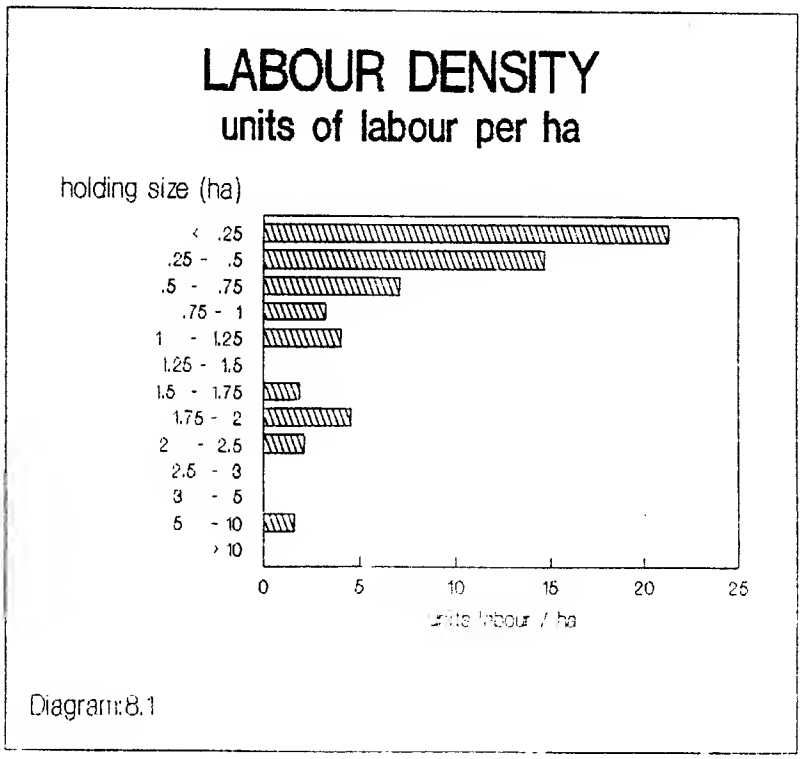


Diagram:8.1

8.5 Holdings without tree crops are shown in table 8.2.

Table: 8.2
LABOUR DENSITY - NON-TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	3.15	0.18	17.20	20
< .25	2.78	0.13	21.28	14
.25 - .5	4.02	0.31	13.14	6
.5 - .75				
.75 - 1				
1 - 1.25				
1.25 - 1.5				
1.5 - 1.75				
1.75 - 2				
2 - 2.5				
2.5 - 3				
3 - 5				
5 - 10				
> 10				

8.6 The range of holding size is much smaller and the mean labour density is 17.20 labour units per hectare. The largest holdings of up to 0.5ha in size have a labour availability of 13.14 units per hectare. There is a decline in labour density from 21.28 to 13.14 units per hectare over the holding size range, but all holdings have a high labour density and suggest high levels of under-employment in agriculture.

8.7 Holdings with tree crops are shown in table 8.3.

Table: 8.3
LABOUR DENSITY - TREE CROP HOLDINGS

holding size class (ha)	units of labour	mean holding area (ha)	labour density (labour/ha)	number of observations
all holdings	5.00	1.55	3.22	18
< .25				
.25 - .5	6.10	0.32	18.99	2
.5 - .75	4.50	0.64	7.08	3
.75 - 1	2.90	0.90	3.23	2
1 - 1.25	4.40	1.08	4.06	5
1.25 - 1.5				
1.5 - 1.75	3.00	1.60	1.88	2
1.75 - 2	8.00	1.76	4.56	1
2 - 2.5	5.20	2.44	2.13	1
2.5 - 3				
3 - 5				
5 - 10	8.65	5.39	1.60	2
> 10				

8.8 Again there is no strong relationship between holding size and labour availability. The mean labour density is 3.22 units per hectare, falling off sharply from 18.99 units per hectare on holdings of less than 0.5ha in size to 1.60 units per hectare on holdings of 5-10ha.

8.9 Larger holdings may experience labour constraints but there is unlikely to be a labour problem on food gardens. In general labour is unlikely to be limiting. Holdings are small while family sizes are large and so there is likely to be considerable under-employment in agriculture.

8.10 It was not possible to investigate land use constraints, for instance whether small holdings are small because of restricted land use rights or because of the urban influence in patterns of employment.

Chapter: 9
CROPPING PATTERNS

9.1 A "holding" is taken here to be the total area cultivated by a household. It includes all crops growing and land cleared, but does not include fallow which the family may have rights to cultivate.

9.2 A holding is divided into one or more "gardens", which are contiguous blocks of land growing similar crops. Only broad distinctions are made among crop types in gardens.

9.3 A garden may be subdivided into "plots" which are blocks within each garden growing a different crop mix, under different management, or planted at different times. Within plots detailed crop mixtures are recorded.

9.4 Table 9.1 describes cropping patterns at the garden level, maintaining the distinction between farmers with tree crop gardens and those without.

9.5 Tree crop farmers have a mean holding size of **1.56ha**, of which **1.23ha** is tree crops and **0.33ha** food crops. In contrast, non-tree crop farmers have a mean holding size of **0.18ha**.

9.6 Tree cropping farmers tend to have more complex holdings, with an average of **2.50** gardens and **5.77** plots compared with **1.55** gardens and **3.60** plots among non-tree crop farmers.

9.7 Table 9.2 describes cropping patterns in more detail. This is derived from the aggregation of plot information in which complex mixtures are summarised by the dominant crop. The resolution by crop changes at the plot level, which refers specifically to the growing of coconuts and cocoa. While an entire garden may not be regarded as a "tree crop" garden, a plot within it may be a "tree crop" plot, and so the breakdown of tree cropping at garden and plot levels does not necessarily correspond exactly.

9.8 9 major crop mixture classes are listed in table 9.2, predominantly coconuts and cocoa and root crops.

Table: 9.1
CROP COMPOSITION

i) All holdings

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	0.58	0.47	0.68	1.45	+++++
short term cash crops					
food crops	0.25	1.53	3.95	2.58	++
total	0.83	2.00	4.63	2.32	

number of observations = 38

ii) Holdings with tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops	1.23	1.00	1.44	1.44	++++++++++++
short term cash crops					
food crops	0.33	1.50	4.33	2.89	+++
total	1.56	2.50	5.77	2.31	

number of observations = 18

iii) Holdings without tree crops

crop category	mean area in holding (ha)	mean no gardens per holding	mean no plots per holding	mean no plots per garden	summary of crop area
cleared land					
tree crops					
short term cash crops					
food crops	0.18	1.55	3.60	2.32	+
total	0.18	1.55	3.60	2.32	

number of observations = 20

Table: 9.2
CROPPING PATTERNS

	main crop in mixture	all farmers		farmers with no tree crops		farmers with tree crops	
		area (ha)	%	area (ha)	%	area (ha)	%
a	Cleared Land	0.024	3	0.037	17	0.007	0
b	Coconut	0.451	54			1.008	64
c	Cocoa	0.111	13			0.248	16
d	Pasture						
e	Grain Crops	0.001	0			0.002	0
f	Beans						
g	Cabbage						
h	Vegetables						
i	Spices						
j	Fruit Crops	0.013	2	0.024	11		
k	Fruit trees						
l	Banana						
m	Citrus trees						
n	Nut trees						
o	Sugar cane						
p	Food/building tree						
q	Tobacco						
r	Sweet Potato	0.210	25	0.138	62	0.299	19
s	Taro	0.016	2	0.016	7	0.014	1
t	Yam	0.002	0	0.002	1	0.002	0
u	Pana	0.003	0	0.004	2	0.001	0
v	Cassava	0.003	0			0.006	0
w	Other root crop						
	Total mean area (ha)	0.832		0.221		1.586	
	Number of households	38		21		17	

Note: Differences in tree cropping between tables 9.1 and 9.2 arise due to differnces in crop dominance at the garden level and the plot level.

9.9 The spatial dominance of coconut cropping on farming systems is seen clearly in diagrams 9.1 to 9.3. Coconuts account for **54%** of the total area but are grown by only **34%** of farmers[30].

9.10 Table 9.2 is still a simplification of cropping patterns found in the field. Table 9.3 describes in more detail the crop mixtures grown by farmers. This no longer applies to a "model" holding but, in aggregate, detailed cropping patterns may be used to determine proportional areas under crop mixtures. Mixtures are listed hierarchically to the left of the table according to the relative dominance of each crop in the mixture. The three main crops are listed by name and any further crops are referred to by code letters. The column of "mean plot area" records the mean area of plots measured in the field according to the number of observations shown in the next column to the right. The column on the far right is the proportional area by crop mixture.

9.11 Crop mixtures illustrate the complexity of smallholder farming systems, in which **61** distinct mixtures are recorded. Small areas of vegetable and short term cash crops are typically scattered among food gardens. Tree crops are important, both within cultivated gardens and in the fallow of former gardens.

9.12 Table 9.4 summarises tree cropping. The table is in two parts, first showing the average number of trees and second the number of observations on which they are based. Each table is subdivided horizontally into cultivated garden and fallow, and vertically by garden type.

9.13 The averages in the top table are based on all plots (not only the plots in which trees are grown). In the far right column of the lower table is listed the number of observations for which trees are too numerous to count. These are excluded from the averages in the upper table.

CROPPING PATTERNS

all farmers

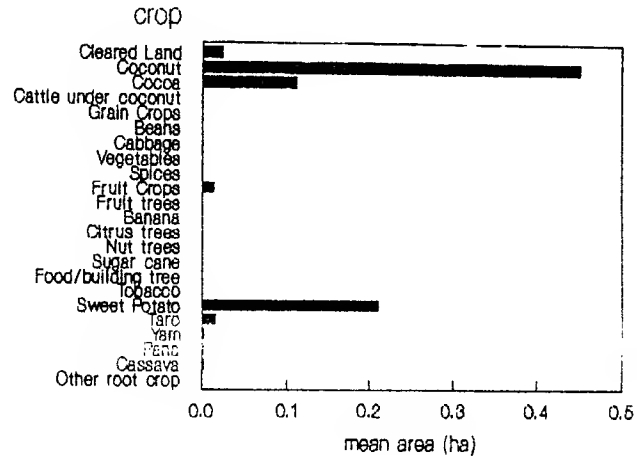


Diagram:9.1

CROPPING PATTERNS

farmers with no tree crops

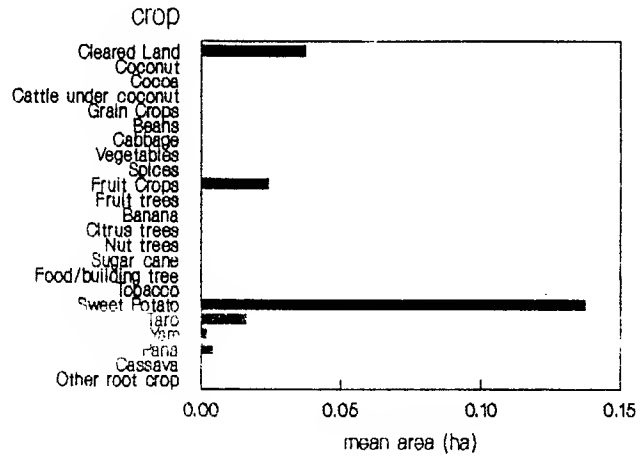


Diagram:9.2

CROPPING PATTERNS

farmers with tree crops

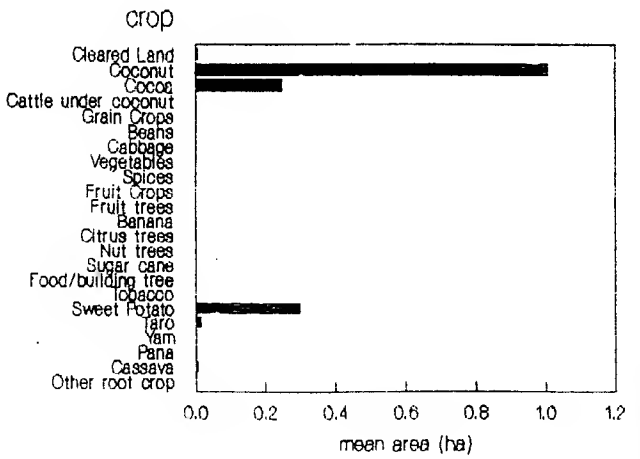


Diagram: 9.3

Table: 9.3
DETAILED CROPPING PATTERNS

crop code	main crop in mixture — crop name: first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
TOTAL					0.0379	176	100	100
a	Cleared land				0.0899	10	6	2.844
b	Coconut				1.8671	9	5	53.14
		Cocoa			0.1654	2	1	1.046
c	Cocoa				0.5893	4	2	7.455
		Coconut			0.3084	6	3	5.851
e	Fruit crops				0.0260	1	1	0.082
j	Fruit crops				0.0422	3	2	0.400
		Tobacco			0.1922	1	1	0.607
		Sweet potato	Sugar cane		0.1030	1	1	0.325
		Cassava			0.0890	1	1	0.281
r	Sweet Potato				0.0590	43	24	8.027
		Grain crops			0.0639	2	1	0.404
		Beans	Banana		0.0235	1	1	0.074
		Cabbage			0.1169	5	3	1.849
			Beans		0.0368	1	1	0.116
			Fruit crops	n	0.1256	1	1	0.397
				s	0.0486	1	1	0.153
			Fruit trees		0.0333	1	1	0.105
			Banana		0.0392	3	2	0.371
			Sugar cane	v	0.0892	1	1	0.282
			Taro		0.0428	2	1	0.270
			Cassava	jl	0.0132	1	1	0.041
				l	0.0305	1	1	0.096
		Fruit crops			0.1446	9	5	4.115
			Sugar cane		0.2302	1	1	0.728
			Cassava		0.0531	3	2	0.504
				gh	0.0933	1	1	0.295
				o	0.1250	1	1	0.395
		Banana	Cabbage		0.1967	2	1	1.244
		Taro			0.0474	7	4	1.049
			Cabbage		0.0589	3	2	0.558
				j	0.0159	1	1	0.050
			Fruit crops	l	0.0350	1	1	0.110
			Banana		0.0473	2	1	0.299
				g	0.1042	1	1	0.329
			Nut trees	l	0.0301	1	1	0.095
			Yam	ulg	0.0435	1	1	0.137
			Cassava		0.0512	2	1	0.323
				g	0.0419	1	1	0.132
				j	0.1811	1	1	0.572

CROPPING PATTERNS (continued)

crop code	main crop in mixture — crop name — first	second	third	minor mixture code	mean plot area (ha)	number of plots	% plots	% area
r		Pana			0.1028	1	1	0.325
		Cassava			0.0608	4	2	0.768
			Cabbage	s	0.0190	1	1	0.060
			Fruit crops	g	0.1060	1	1	0.335
			Banana		0.0620	1	1	0.196
				j	0.0198	1	1	0.062
			Taro	g1	0.0354	1	1	0.111
s	Taro				0.0313	10	6	0.990
		Cabbage			0.1065	1	1	0.336
			Sugar cane	1	0.0165	1	1	0.052
		Fruit crops	Other root	q	0.0257	1	1	0.081
		Tobacco	Fruit crops		0.0151	1	1	0.047
		Sweet potato			0.0359	2	1	0.227
			Cabbage		0.0840	1	1	0.265
		Pana			0.0180	1	1	0.056
t	Yam	Pana	taro		0.0399	1	1	0.126
				1joq	0.0295	1	1	0.093
u	Pana				0.0271	3	2	0.257
		Taro			0.0054	1	1	0.017
			Cabbage	o	0.0249	1	1	0.078
v	Cassava	Banana			0.0368	1	1	0.116
		Sweet potato			0.0680	1	1	0.215

Crop Key:

a Cleared land	j Fruit crops	r Sweet potato
b Coconut	k Fruit trees	s Taro
c Cocoa	l Banana	t Yam
e Grain crops	m Citrus trees	u Pana
f Beans	n Nut trees	v Cassava
g Cabbage	o Sugar cane	w Other root crop
h Vegetable	p Food/building tree	
i Spices	q Tobacco	

Table: 9.4
TREE CROPS IN GARDENS

(---------- average number of trees per garden ----------)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) In cultivated gardens:					
fruit trees				0.46	0.35
citrus				0.05	0.04
nut trees		0.36		0.43	0.42
sweet banana		0.22		1.23	0.99
cooking banana		0.22		2.40	1.86
ii) In fallow of gardens:					
fruit trees					
citrus					
nut trees				0.48	0.37
sweet banana				0.50	0.38
cooking banana		0.35		0.46	0.35

(---------- number of observations ----------)

crop type:	cleared land	tree crops	short term cash crops	food crops	many but "unknown"
i) In cultivated gardens:					
fruit trees		18		57	1
citrus		18		58	
nut trees		14		58	4
sweet banana		18		56	2
cooking banana		18		55	3
ii) In fallow of gardens:					
fruit trees		18		58	
citrus		18		58	
nut trees		17		58	1
sweet banana		18		54	4
cooking banana		18		54	4

9.14 Bananas, particularly cooking bananas, are an important crop, and to a lesser extent nut trees and fruit trees. Citrus is of lesser importance.

Chapter: 10
COCONUT AND COCOA

10.1 Coconut and cocoa have been studied in some detail before, both in the 1974-75 Sample Survey of Agriculture[5] and in the 1985 Coconut Survey[6]. Only comparative data are therefore included in the present survey.

10.2 Copra exports from Solomon Islands started in the late 19th century, rising from **1,220 MT** in 1895 to **23,000 MT** in the '20s and '30s. Following disruption during the second world war production did not achieve pre-war levels again until the 1960s. Copra production has continued to rise since, exceeding **40,000 MT** in 1984 and 1985. Following cyclone Namu copra production fell by about 20 to 25%, but showed some recovery in 1987/88.

10.3 The structure of the copra economy has varied considerably since the start of trading. Initially a smallholder crop, the plantation sector came to dominate production from 1915 onwards. Since the 1970s smallholder production has been growing by about **4.5%** annually and smallholder copra production now accounts for around **70%** of the total[8].

10.4 The area under smallholder coconuts has expanded considerably over the past 15 years, in part due to a subsidy scheme operating from 1968 to 1978 which was designed to encourage the rehabilitation, planting and replanting of coconut palms. Consequently the age structure of smallholder palms is young, with almost half the palms planted since 1970 and nearly **90%** planted since the war[8].

10.5 The total number of coconut palms in Solomon Islands is estimated to be around **9 million**, covering an area of approximately **60,000 hectares**. Table 10.1 shows the provincial breakdown of copra production, in which Western, Guadalcanal, Malaita and Central Provinces account for about **80%** of production.

10.6 The mean national copra yield is 0.72 MT per hectare according to the 1985 Coconut Survey[7]. The 1974-75 Sample Survey of Agriculture found that the average number of coconuts per palm was 36 (30 in the 1985 Coconut Survey) and assumes an average whole nut weight of 1.2kgs with 190gm dried copra equivalent per nut. Disciplined plantings were found to yield 40% more per tree than customary plantings, but only 7% more per unit area because of the greater density of customary planted trees. This result was was questioned in the 1985 Survey.

Table: 10.1
COPRA AREA AND PRODUCTION BY PROVINCE (1984)

Province	(-- area --)		(-- production --)		yield	number of palms
	(ha)	%	(MT)	%	(MT/ha)	
Western	14,454	25	13,816	32	0.96	2,093,795
Ysabel	5,230	9	2,969	7	0.57	817,555
Central	7,909	13	9,073	21	1.15	1,287,680
Guadalcanal	12,758	22	7,324	17	0.57	1,824,790
Malaita	11,890	20	5,575	13	0.47	1,980,595
Makira	3,555	6	2,662	6	0.75	540,810
Temotu	3,032	5	1,167	3	0.38	494,420
Total	58,918	100	42,586	100	0.72	9,039,645

Source: Statistics Office, Solomon Islands (1986), Statistical Bulletin 18/86

10.7 The yield from well maintained plantations was found to be higher than from poorly maintained plantations, but the 1985 Coconut Survey attributed this to more intensive harvesting rather than the productivity of palms[5].

10.8 In the 1985 Coconut Survey soil type was classified into three broad categories. 41% of plots lay on sand or coral; 47% on black alluvial soils; and 21% on red clay. It was concluded that the reason for low yields is often area specific but soil nutrient deficiency, notably potassium, is an important factor. Despite this, and high copra prices at the time, the 1974-75 survey found that "fertilizer is only applied when provided under some sort of subsidy scheme" and that "smallholder farmers will not buy fertilizer to use on their own plots. There is generally a lack of understanding of the use of fertilizer by farmers, and in many cases a reluctance to use it even when it is provided at a subsidised price"[5].

10.9 Other important factors identified in the 1985 Coconut Survey as affecting production were pests and disease. Over half the plots sampled in the 1985 suffered from Leaf Spot, which may refer to the symptoms of pest infestation or nutrient deficiency. One quarter of plots showed some evidence of White Thread, but it was felt that neither problem significantly affected output. About 40 ot 50 percent of plots were felt to be disease free[7].

10.10 Amblypelta cocophaga appeared to be a significant pest in parts of Western province, the Floridas, Guadalcanal and Malaita. 38% of households reported premature nutfall which is linked to Amblypelta in certain localities. Brontispa spp was also evident, and minor pests included rhinoceros beetle (Scapanes australis), rats, cockatoos, flying foxes and others[7].

10.11 The coconut survey of 1985 found that the average spacing of 7.5metres for palms was not significantly different between triangular and square planted plots. On customary plantings there was a wide variation in planting density, but the majority of plots were similar to disciplined plantings[7].

10.12 The 1974-75 sample survey of agriculture found that more than half of all immature palms were well maintained. Among bearing trees more than 60% of disciplined plantings were well maintained compared to 47% of customary planted palms[5]. The 1985 coconut survey found lower management standards, and that even with 30% of farmers hiring workers to assist with maintenance only 39% of plots were well brushed. 47% revealed weed growth to shoulder height, and 13% of plots were totally neglected[7]. The relationship between levels of maintenance, yield and soil conditions was not established in the 1985 survey.

10.13 Table 10.2 presents additional results from the present study. 50% of coconut plots are pure stand and 50% are intercropped with cocoa. 38% of cocoa plots are pure stand and 62% are intercropped with coconuts.

10.14 Maintenance levels in the survey area are summarised in table 10.2. 25% of coconut plots have reverted to secondary bush but in general coconut and cocoa plots are well maintained. Maintenance levels are illustrated in diagram 10.1.

Table: 10.2
COCONUTS AND COCOA

	⟨------- % plots ------⟩		
	coconut	cocoa	coconut + cocoa
i) Intercropping:			
Pure stand	100	100	
Intercropping with:			
Coconut + cocoa			100
Short term cash crops			
Food crops			
Livestock			
Total %	100	100	100
Number of observations (plots)	8	5	8
ii) Maintenance:			
Undercropped	13		
Brushed to ground level	13	100	63
Brushed to shoulder height	50		25
Secondary bush	25		13
Burnt			
Total %	100	100	100
Number of plots	8	5	8
iii) Coconut variety composition			
Tall	100		100
Rennel			
Dwarf			
Other			
Total %	100		100
Number of plots	8		8
iv) Coconut age composition			
⟨ 8 years			
9 - 16 years	16		
17 - 40 years	84		100
⟩ 40 years			
senescent			
Total %	100		100
Number of plots	8		8

v) Cocoa age composition

< 3 years	20	13
3 - 5 years	40	30
6 - 25 years	40	58
> 25 years		
Total %	100	100
Number of plots	5	8

vi) Cocoa shade

coconuts		100
planted shade	20	
natural shade	20	
planted and natural	60	
Total %	100	100
Number of plots	5	8

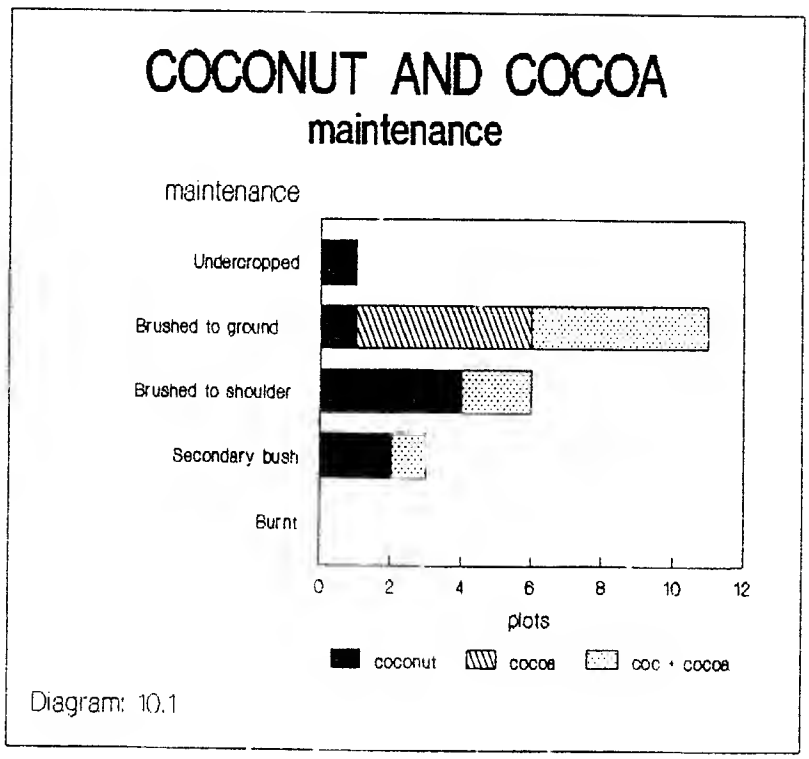


Diagram: 10.1

10.15 In the survey the coconut variety is entirely local tall. 16% are less than 16 years of age and 84% are in the age band 17-40 years.

10.16 13% of cocoa plots in mixed stands with coconuts are less than three years of age, 30% are in the age interval 3-5 years, and 58% are in the age class 6-25 years. A similar age composition is seen on pure stand plots. In pure stand cocoa 20% of plots have planted shade, 20% have natural shade and 60% have a mixture of planted and natural shade.

Chapter: 11
FALLOW

11.1 Throughout Solomon Islands almost all gardens are cultivated according to a form of shifting cultivation with bush fallow. In the 1974-75 Sample Survey of Agriculture it was found that, where population density or land tenure problems have restricted the availability of suitable land, the length of fallow may be reduced from the optimum 7 to 20 years to as little as one or two years. In such areas soil fertility is diminished through over frequent cropping[5].

11.2 Solomon Islands soils generally have a low to very low potassium status. The geology of the country is composed in the main of rocks which are low in potassium bearing minerals, and potassium is readily leached under conditions of continuously high rainfall and rugged topography. Fallow is essential for the restoration of potassium fertility: "Under traditional shifting cultivation the depletion of potassium by crops is gradually reversed over a period of 3-15 years or more by a combination of mineral weathering and root systems incorporating potash in the nutrient cycle". Although burning leads to an erratic distribution of potassium in the topsoil, "the burning of vegetative trash is beneficial and it has been shown that topsoil potassium is increased by as much as 100% on average after burning, all of this increase being held by the exchange complex"[9].

11.3 Research on Malaita has shown that the average tuber yield of sweet potato is **9.3t/ha** on sites of more than 10 years of fallow, falling off rapidly to **6.0t/ha** on land of 5 - 9 years of fallow; **4.8t/ha** on land of 0 - 4 years of fallow; and **3.5t/ha** on successively cropped land. A residual yield of 2 - 6t/ha "seems to represent the rate of release of potassium from slowly available reserves in soil and weathering parent material within rooting depth". Large amounts of fertiliser are required to restore yields. A supply of 112kg/ha K is only marginally beneficial and inadequate to replenish the rate of potassium removal by the crop. 200 to 300kg/ha K is said to be required to restore yields to levels commensurate with long fallow periods[9].

11.4 Phosphorus varies widely in its total and available forms, but Solomon Islands soils generally have low levels in the subsoil and medium levels of total phosphorus in the topsoil. Most soils used for agriculture have satisfactory levels of phosphorus but as land pressure increases deficiencies may become more widespread. Humus in the topsoil is accompanied by an increase in phosphorus, mainly in organic form, which may become readily available[9].

11.5 Soil total nitrogen levels are generally adequate, with C:N ratios in the range 7-13 signifying the ready availability of nitrogen. Topsoil nitrogen is dependent on land use and in particular the length of fallow since there is a build-up of topsoil nitrogen under secondary regrowth. Sulphur is similarly associated with organic matter, and is higher under forest than under burned grassland[9].

11.6 There is a close relationship between pH and organic matter. The lower the pH the greater the surface organic matter and the higher the subsoil organic carbon content. Difficulties associated with low pH such as aluminium toxicity are only likely to be widespread in the New Georgia group and possibly Ysabel. Alkaline soils are fairly widespread and are associated with reef limestone. The chief problem induced by alkaline calcareous soils is lime induced chlorosis of foliage which results from deficiencies of iron, manganese, zinc and copper[9].

11.7 In addition there is a close relationship between soil depth and soil fertility. "All stable sites tend to favour an accumulation of maximum weathered material due to minimal losses by surface erosion. Thus there arises the paradox that on stable hill sites and terraces the soils tend to be deepest but least fertile, while on adjacent steep slopes the soils are relatively unweathered, and hence fertile, but shallow"[9].

11.8 The shifting system of smallholder agriculture in Solomon Islands is suited to the environment and prevailing management where land pressure is low. Soil fertility is restored during fallow periods, and small isolated areas of mixed cropping are not conducive to pest build-up. Burning of surface vegetative trash not only releases a flush of nutrients, of which the most important is potassium, but is also a useful phytosanitary measure which destroys weed seeds, some insects and undesirable pathogens[9].

11.9 An analysis of fallow therefore tells much about the dynamics of smallholder agriculture, and likely pressures on farming systems. Hansell and Wall[10] state that "there is little doubt that the major factor influencing the decision to abandon the garden is the decline in crop productivity but the exact causes of the decline are not fully understood". The greatest decline in production is between the first and second crops, rather than between the second and subsequent crops. They estimate that despite reduced yields there is still a good return from a low input of labour and conclude that reduced yields alone is insufficient reason for the abandonment of a garden. An important consideration may be the build-up of soil-borne plant diseases causing the rotting of corms or tubers, insect attack and weed infestation[10].

11.10 In the 1974-75 Sample Survey of Agriculture[5] it was stated that, while in overall terms Solomon Islands cannot be said to be suffering from land pressure, it may occur in some areas. Table 11.1 shows the distribution of garden land by the length of the bush fallow in 1975.

Table: 11.1
LENGTH OF BUSH FALLOW (1975)

length of bush fallow (years)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 2	23	6	17	16	14
2 - 4	20	5	33	14	18
5 - 7	4	11	25	12	15
8 - 10	10	10	8	15	10
> 10	13	20	3	14	13
never previously cultivated	29	48	15	29	32
Mean length fallow (years)	5.6	9.2	4.5	6.7	6.4

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.11 Table 11.2, also from the 1974-75 survey, shows the distribution of garden land by length of cultivation.

Table: 11.2
LENGTH OF CULTIVATION (1975)

length of cultivation (months)	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
	% observations				
< 4	20	45	11	19	27
4 - 6	62	31	36	22	37
7 - 9	12	13	25	33	19
10 - 12	5	8	14	18	10
> 12	2	4	14	8	7
Mean cultivation (months)	5.1	4.7	7.6	7.2	6.0

Source: Statistics Office (1978), 1974-75 Agricultural Statistics Survey

11.12 In 1975 it was found that **32%** of gardens in Solomon islands had never been previously cultivated, and that the average length of bush fallow of cultivated gardens was **6.4** years. Only **7%** of gardens were generally cultivated for more than 12 months before reverting to fallow, and the average length of cultivation of food gardens was **6** months.

11.13 Table 11.3 summarises cropping intensity in the survey area. The crop period is shown in the first column, which is the time from planting to harvest for the named crop.

Table: 11.3
CROPPING INTENSITY

crop type		harvest to harvest (months)	number of crops in sequence	number of cases included (crops)	cases excluded
all crops		4.9	3.4	155	21
cleared land	a	4.0	2.1	6	4
coconut	b	6.3	2.3	3	8
cocoa	c	3.0	1.5	2	8
grain crops	e	3.0	5.0	1	
fruit crops	j	6.3	4.8	6	
sweet potato	r	4.3	3.7	111	
taro	s	7.4	3.3	17	1
yam	t	8.5	3.0	2	
pana	u	7.4	2.6	5	
cassava	v	7.5	3.0	2	

Note: Cases are excluded when the harvest time is continuous or unknown.

11.14 The second column describes the number of times an area is cropped in sequence before reverting to fallow. This introduces complexity since the crop type may, and commonly does, change within the sequence. Thus yam will commonly be followed by sweet potato, which may be followed later by cassava. The table therefore shows different stages in the cropping sequence. The dominant crop is sweet potato with 111 observations and taro with 17 observations. Minor root crops are pana, yam and cassava.

11.15 The dominance of sweet potato is in part due to land pressure, where sweet potato provides higher production than other crops. This has substituted for taro, traditionally the most important crop in the area, which has declined in importance over the years as a result of soil exhaustion, but in particular due to the effects of diseases alomae and bobone which are caused by viruses.

11.16 Table 11.4 describes the fallow period, however, this has little meaning for tree crops since the interpretation of fallow varies with the age of the tree crop and previous cropping history. For food crops the fallow period relies on the knowledge of the respondent. Often it is found that long fallow periods are beyond the memory of operators and these are referred to as "cases longer than memory". 47% of gardens have such long fallows. Where the fallow period is known on food gardens there are 5.2 years of fallow between cropping.

Table: 11.4
FALLOW PERIOD (years)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
mean years of fallow		6.0		5.2	5.3
standard deviation (years)		7.1		4.6	4.8
number of cases (gardens)		4		36	40
cases longer than memory					36
total cases (gardens)					76

11.17 Fallow periods cover a range of soil and site conditions, and are themselves variable. Table 11.5 shows that 38% of fallow periods on food gardens are longer than memory, representing 29% of the food garden area. While cropping is generally intensive, long fallow periods remain in some areas.

Table: 11.5
FALLOW RANGE

i) Fallow Range by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		2		1	3
1 year				5	5
2 years				5	5
3 years				6	6
4 years				4	4
5 years				6	6
6 - 10 years		1		4	5
11 - 20 years		1		5	6
21 - 50 years					
beyond memory ("long time")		14		22	36
total by crop type		18		58	76

ii) Fallow Range by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no fallow		19			19
1 year				3	3
2 years				3	3
3 years				3	3
4 years				3	3
5 years				3	3
6 - 10 years		3		3	6
11 - 20 years		6		3	9
21 - 50 years					
beyond memory ("long time")		41		9	50
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

11.18 The type of fallow in the survey area is shown in table 11.6.

Table: 11.6
FALLOW TYPE
i) Fallow type by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		5		5	10
secondary forest		8		23	31
dense thicket		2		27	29
open scrub grassland				1	1
grassland				1	1
planted trees or fallow		1			1
no fallow		2		1	3
total by crop type		18		58	76

ii) Fallow type by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
primary forest		13		3	16
secondary forest		18		9	47
dense thicket		3		16	19
open scrub grassland					
grassland					
planted trees or fallow					
no fallow		19			19
total by crop type		72		28	100

Note: The table of % area is only approximate due to rounding small numbers.
The area under "no fallow" is disproportionately large due to one very large tree garden.

11.19 **54%** of all gardens have a fallow of primary or secondary forest, representing **47%** of the cultivated area. A further **38%** of gardens on **19%** of the cultivated area are under dense shrubby thicket.

11.20 **11%** of the food garden area is cut from primary forest compared with **18%** of the tree area. Since tree areas are static and semi-permanent while annual cropping is constantly shifting, the encroachment of food gardens on the primary forest is relatively rapid with respect to the area under annual crops.

Chapter: 12
LANDFORM

12.1 The survey area, on the north-west coast of Malaita between Auki and Dala, is densely populated among the coastal lowlands where there is good road access but limited land available for cropping. In contrast land in the uplands is abundant and population is sparse. The dense population of the coastal lowlands has taken place in recent times, when people of the highland interior came to settle along the coast. Good road access to Auki and related services now retain people despite land pressures and the abundance of fertile land not far away in the interior. Difficulty of access to the interior is an impediment to the more extensive development of the area, although agricultural settlement along the road from Dala to Atori has been slow to establish. There are a series of UNDP/ILO Project "self-help" access roads being built into the foothills to increase the penetration of services and improve access to the interior and so to extend the agricultural potential of the area.

12.2 The area is extensively logged and the coastal population has become considerably urbanised with mixed rural-urban employment.

12.3 Landforms are broadly subdivided into "lowland" and "upland" where "upland" simply means above the coastal plain or coastal terrace, but does not imply high elevation. Table 12.1 shows the distribution of cultivated land in the survey by landform. The first part of the table records the number of observations (gardens) and is expressed in area terms in the second part of the table.

12.4 **83%** of tree gardens representing **92%** of the tree garden area are on lowland sites, with the remainder on gently sloping upland sites. The majority of food crop gardens are also on lowland sites. **76%** of food crop gardens representing **89%** of the food garden area are on the lowland plain. **24%** of food gardens representing **11%** of food garden area are on upland, mostly gently sloping sites.

Table: 12.1
LANDFORM

i) Landform by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach		2			2
lowland plain		8		27	35
depression (poor drainage)		2			2
swamp					
river channel		2		3	5
uplifted terrace		1		14	15
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		3		9	12
hill slope 8 - 30 degrees				3	3
hill slope > 30 degrees					
ridge				2	2
total by crop type		18		58	76

ii) Landform by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Lowland					
beach		6			6
lowland plain		34		13	47
depression (poor drainage)		6			6
swamp					
river channel		16		3	19
uplifted terrace		3		9	13
ii) Upland					
valley terrace					
river channel					
hill slope < 8 degrees		6		3	9
hill slope 8 - 30 degrees					
hill slope > 30 degrees					
ridge					
total by crop type		72		28	100

Note: The table of % area is only approximate due to rounding small numbers

12.5 A summary of landform and cropping is illustrated in diagram 12.1.

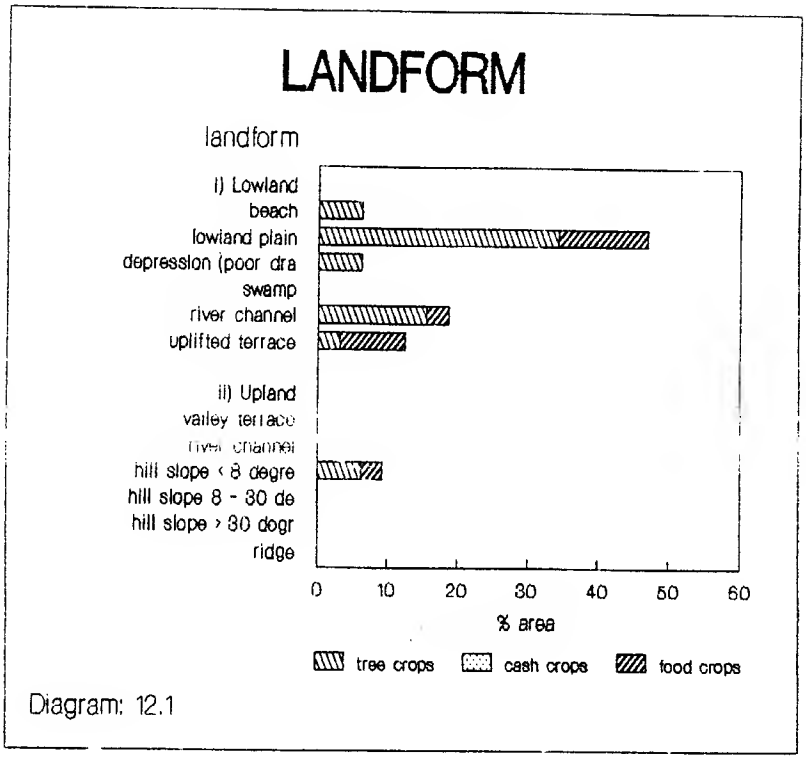


Diagram: 12.1

12.6 Table 12.2 describes the characteristics of slope in farming systems. The first part of the table records the frequency of observations (plots) which is expressed in area terms in the second part of the table.

12.7 The mean slope is 3 degrees. 140 plots or **80%** of all plots, representing **90%** of the total cultivated area, are on sites of less than 5 degrees slope. Only **3%** of the cultivated area is on slopes of greater than 10 degrees.

Table: 12.2

SLOPE

i) Slope by number of observations (gardens)

crop type		mean slope (degrees)	frequency of plots at different degrees of slope						frequency of plots
			0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	› 50 degrees	
all plots		3	140	29	3	1	3		176
cleared land	a	3	8	2					10
coconut	b	4	9	1			1		11
cocoa	c	2	9	1					10
grain crops	e		1						1
fruit crops	j	3	5		1				6
sweet potato	r	3	88	19	2	1	1		111
taro	s	5	12	5			1		18
yam	t		2						2
pana	u	1	5						5
cassava	v	5	1	1					2

ii) Slope by % cropped area

crop type		frequency of plots at different degrees of slope						total
		0 - 5 degrees	5 - 10 degrees	10 - 20 degrees	20 - 30 degrees	30 - 50 degrees	› 50 degrees	
all plots		90	7			3		100
cleared land	a	3						3
coconut	b	52	3			3		59
cocoa	c	14						14
grain crops	e							
fruit crops	j							
sweet potato	r	21	3					24
taro	s							
yam	t							
pana	u							
cassava	v							

Note: The table of % area is only approximate due to rounding small numbers

12.8 Table 12.3 summarises conservation measures, however, this simply verifies that no conservation methods or alley cropping were encountered in the survey.

Table: 12.3
CONSERVATION AND ALLEY CROPPING

i) Conservation by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		18		58	76
ii) Alley cropping not performed performed		18		58	76
total by crop type		18		58	76

ii) Conservation by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
i) Conservation none contour cultivation bunding terracing		69		31	100
ii) Alley cropping not performed performed		69		31	100
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

12.9 The spatial distribution of gardens is shown in diagrams 12.2 to 12.4, which illustrate the relationships between crop type, crop area, and the distance of gardens from households.

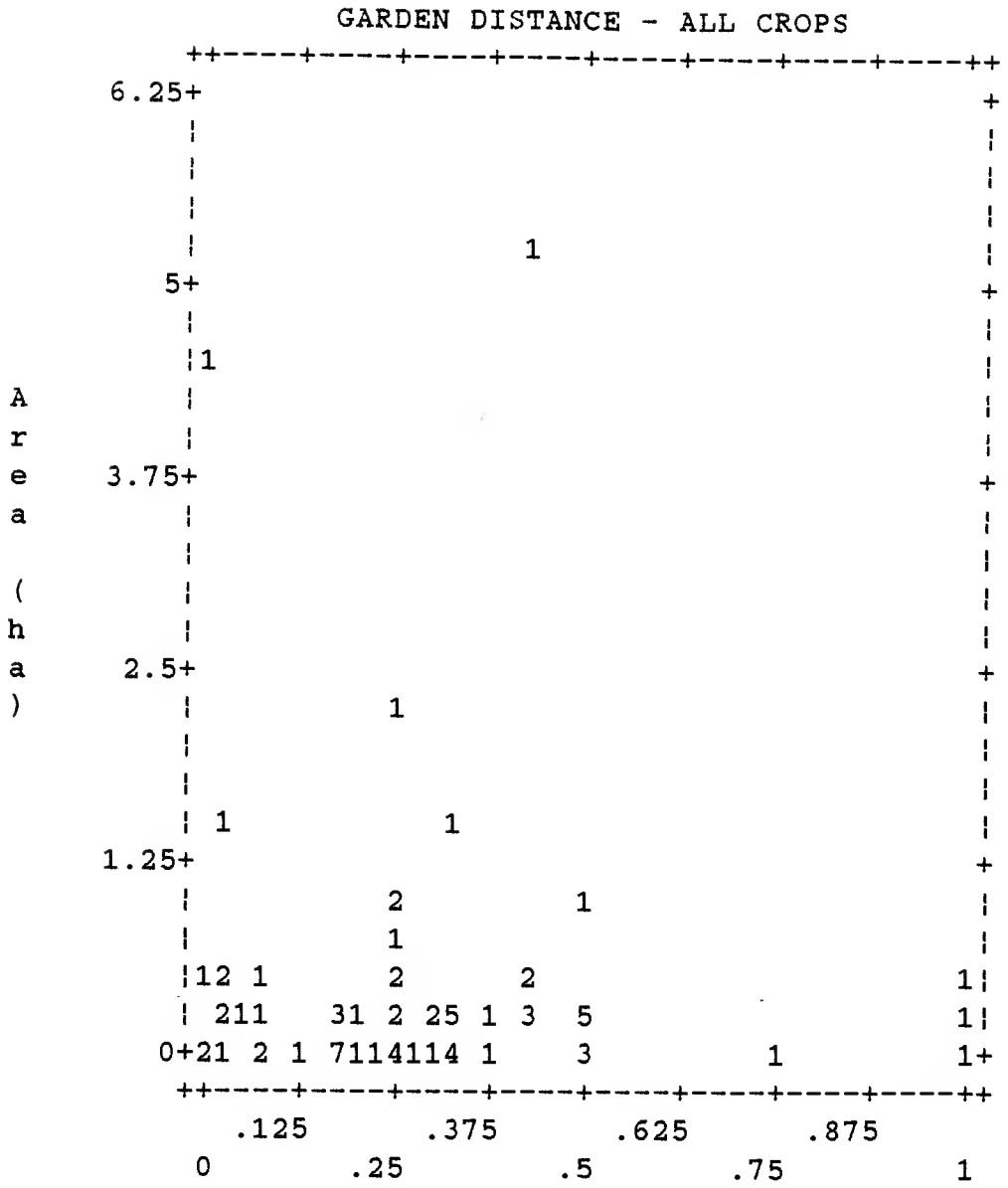
2.10 Diagram 12.2 is the graph of gardens for all crops, while subsequent diagrams show the distance relationships for the major crop types. The graph shows the relationship between garden area (vertical axis) and the time taken to reach the garden from the household (horizontal axis). Graph entries represent the number of observations (gardens) and are numbered from 1 to 9 and thereafter alphabetically. Thus where points coincide the number of points is shown: 9 occurrences is recorded as "9"; 10 occurrences as "A"; 13 occurrences as "D"; and so on.

12.11 The mean time taken to reach gardens is .190 hours, or about 11 minutes, with a maximum time recorded as 1.00 hours. Garden size tends to be fairly uniform irrespective of distance from the household.

12.12 Diagram 12.3 shows the relationship between distance and area of tree crop gardens. The mean time taken to reach tree crop gardens from the household is .214 hours, with a maximum recorded time of 1.00hrs. There is a weak positive trend in which larger gardens tend to be further away from households.

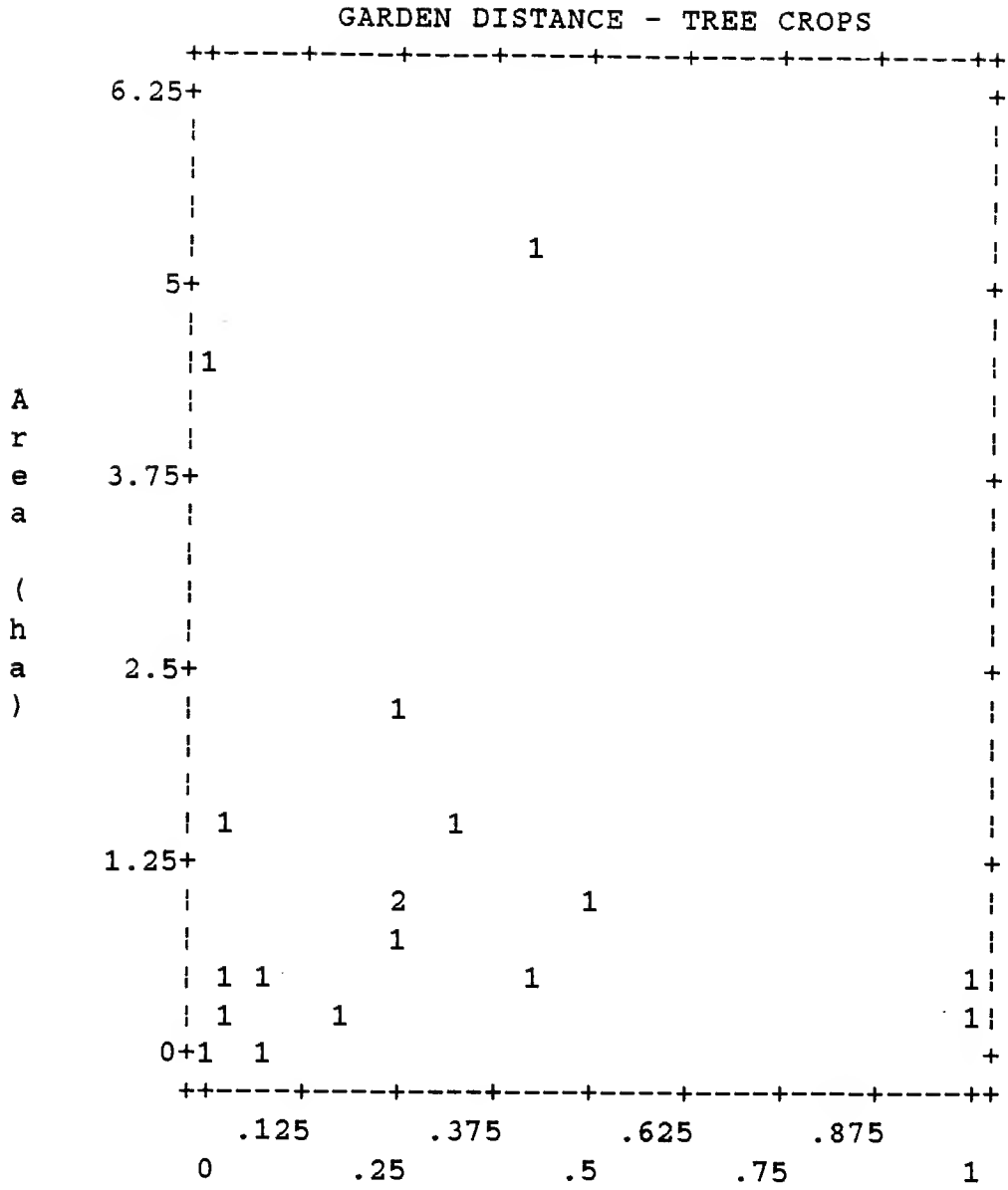
12.13 The mean time taken to reach food gardens from the household is .182 hours, with a maximum time of 1.00 hours. Diagram 12.4 shows that garden area is variable while distance is relatively constant.

Diagram: 12.2



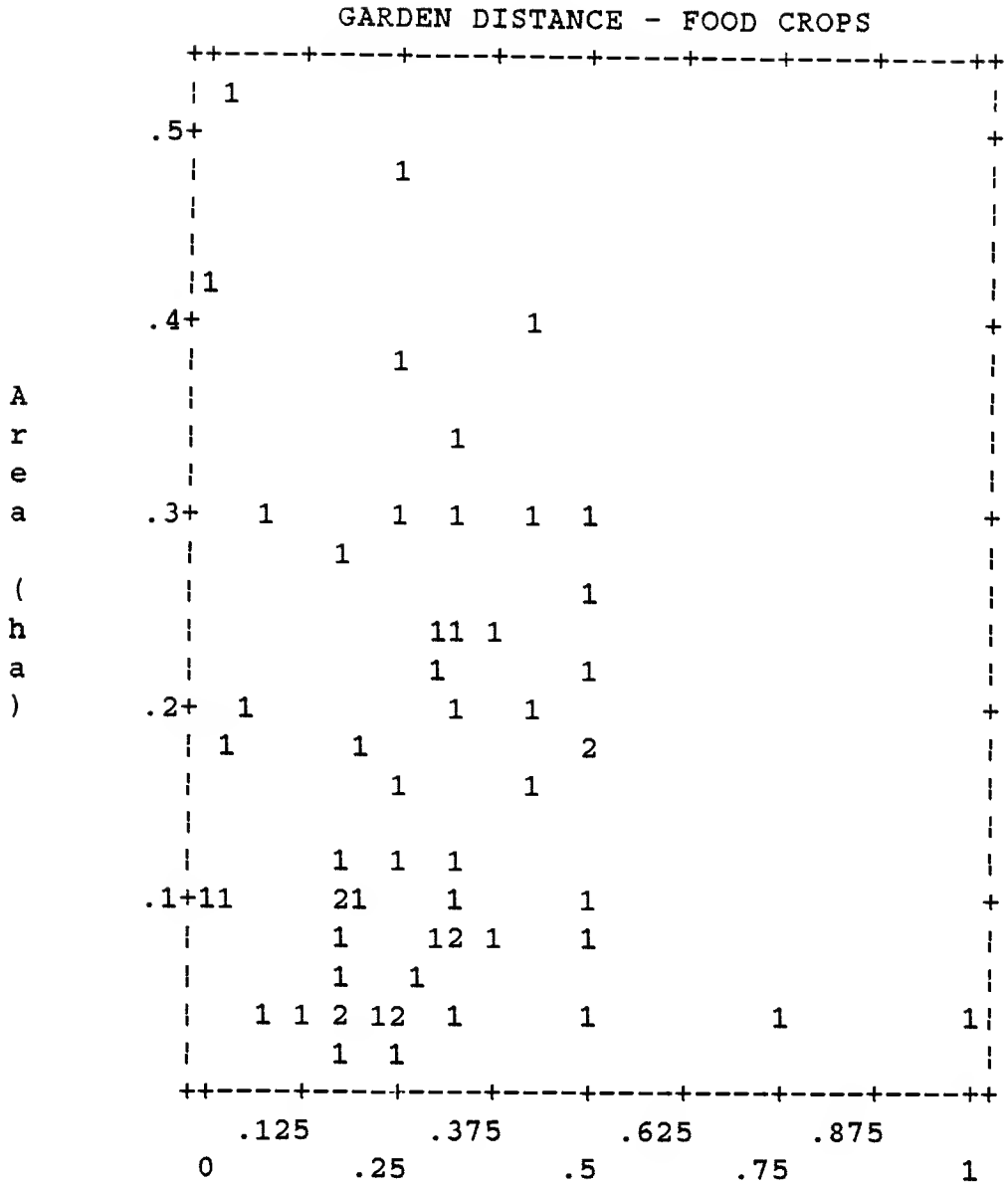
Mean = .190 hrs
Max = 1.00 hrs
Number of observations (gardens) = 76

Diagram: 12.3



Mean = .214 hrs
Max = 1.00 hrs
Number of observations (gardens) = 18

Diagram: 12.4



Mean = .182 hrs
Max = 1.00 hrs
Number of observations (gardens) = 58

Chapter: 13
ADVERSE FACTORS AFFECTING PRODUCTION

13.1 Table 13.1 describes site factors which farmers regard as problems. The first part of the table specifies the number of observations (gardens), which is expressed as the proportion of cultivated area affected in the second part of the table.

Table: 13.1
SITE CONDITIONS

i) Site Conditions by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		4		35	39
poor soil/site		1		5	6
pest/disease problem		3		10	13
poor site + pests		2		1	3
weed problem		3		1	4
weeds + poor site		2			2
weeds + pests		2		5	7
weeds + site + pests		1		1	2
total by crop type		18		58	76

ii) Site Conditions by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no site limitation		23		17	40
poor soil/site		3		3	7
pest/disease problem		3		7	10
poor site + pests					
weed problem		30			30
weeds + poor site		7			7
weeds + pests		3		3	7
weeds + site + pests					
total by crop type		70		30	100

Note: The table of % area is only approximate due to rounding small numbers

13.2 **51%** of all gardens (39 gardens) but representing only **40%** of the cultivated area have no site limitations. Site problems may be summarised by grouping the main factors as follows:

	% gardens	% area
No site limitations	51	40
Poor soil/site	17	14
Pests/disease	33	17
Weeds	20	45

Site conditions are illustrated in diagram 13.1.

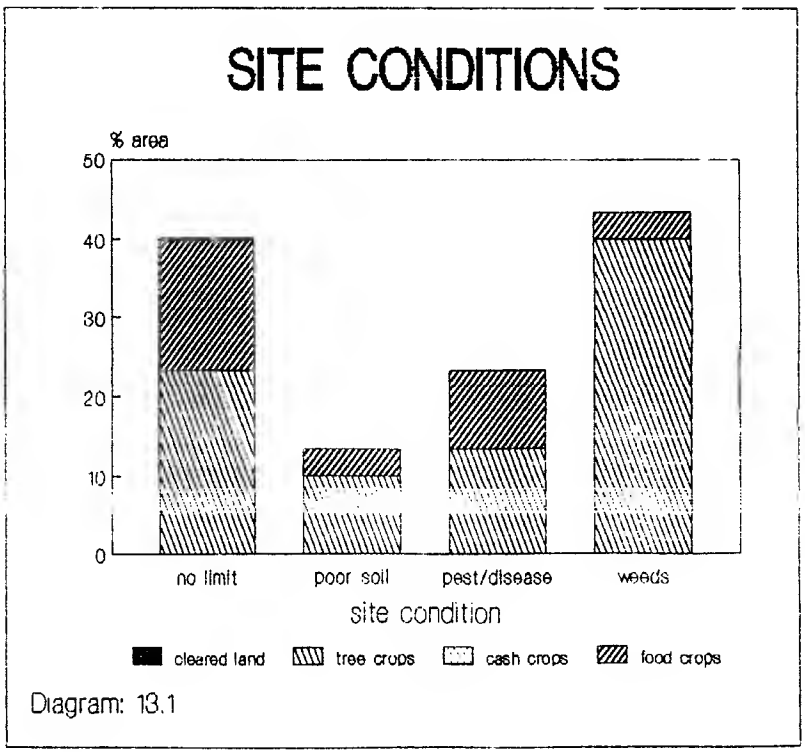


Diagram: 13.1

13.3 The major problem is weeds affecting **45%** of the cultivated area, although pests and disease also affect **17%** of the cultivated area and **14%** of the cultivated area suffers from poor soils or site factors. Tree crop management encounters major problems, of which weeds are dominant, but poor soil and pests and disease also affect large areas. **22%** of tree crop plantings are affected by problems on **67%** of the tree crop area.

13.4 **40%** of food gardens are affected by problems on **43%** of the food garden area. Pests and disease are the dominant problems affecting root crops with lesser problems from poor soil or site factors and weeds.

13.5 Table 13.2 describes crop damage in which **17%** of tree crop gardens are cyclone damaged on **13%** of the tree garden area. **11%** of tree gardens on **7%** of the tree garden area show other forms of crop damage. **16%** of food gardens on **19%** of the food agrden area show crop damage.

Table: 13.2
CROP DAMAGE

i) Crop Damage by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		13		49	62
cyclone damage		3			3
other damage		2		9	11
cyclone and other damage					
total by crop type		18		58	76

ii) Crop Damage by % area of holding

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no damage		53		25	78
cyclone damage		9			9
other damage		6		6	13
cyclone and other damage					
total by crop type		69		31	100

Note: The table of % area is only approximate due to rounding small numbers

13.6 Annex 3 provides a more detailed description of factors damaging crop mixtures, summarised at the plot level. It is not possible at this stage to present results at the crop level. Results are summarised in table 13.3 and are illustrated in diagram 13.2.

Table: 13.3
SUMMARY OF CROP DAMAGE

nature of damage		% cropped area affected
insects affecting	leaves	13
	fruits	38
	roots	6
disease affecting	leaves	3
	fruits	28
	roots	
damage due to	humans	9
	fire	9
	flood	
	wind	28
	rats	34
	birds	13
	bats	
	livestock	
	other	

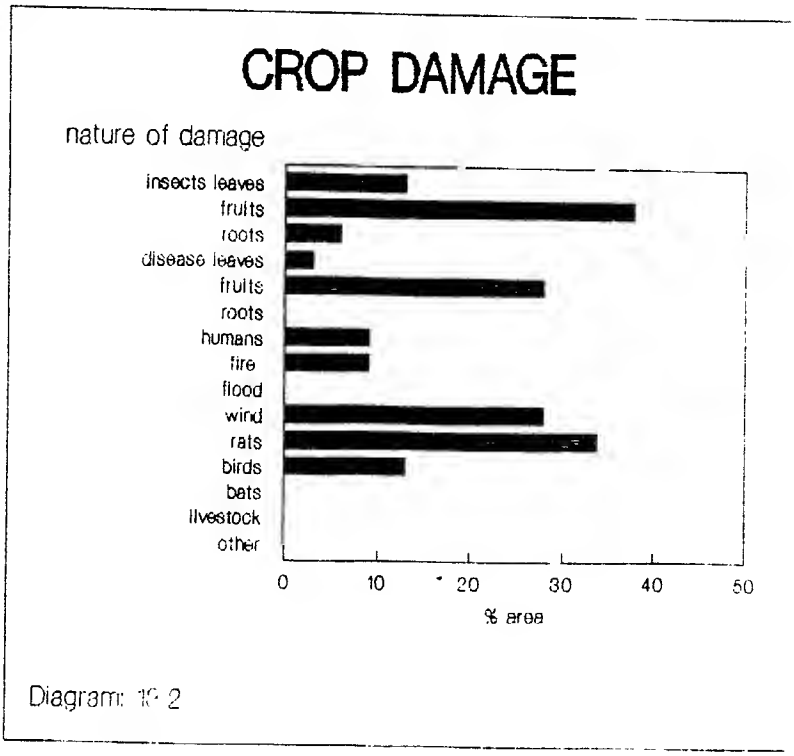


Diagram 13.2

Chapter: 14
CROP YIELDS

14.1 Production data on smallholder agriculture are scarce, largely due to practical difficulties associated with measuring yields in complex cropping systems that lack clear temporal and spatial boundaries. Smallholder agriculture is a continuous process in which there is little seasonality, so that any or all stages of crop growth and management operations may be exhibited at any time, with crops commonly harvested selectively over time. Table 14.1 summarises the planting characteristics of smallholder crops in the survey area.

Table: 14.1
CROP VARIETY AND SPACING

crop type		number of observations	% improved	spacing (% obs) customary	spacing (% obs) regular	spacing (% obs) recommended tree crops triangular	spacing (% obs) recommended tree crops square
Cleared	Cleared land						
Coconut/Cocoa	Coconuts	16	13	31	25	19	25
	Cocoa	12	33	33	25	42	
Ground crops	Grain crops	7	14	86	14		
	Beans	3		100			
	Cabbage	47		98	2		
	Vegetable	2	50	100			
	Chillie						
	Fruit Crops	39		77	23		
Tree/other crops	Fruit trees						
	Banana	28		82	18		
	Citrus trees						
	Nut trees	2		50	50		
	Sugar cane	7		86	14		
	Food/building tree						
	Tobacco	5		100			
Root crops	Sweet potato	115	2	100			
	Taro Common	48		100			
	Giant	11		100			
	Hong Kong	7		100			
	Swamp						
	Yam	7		100			
	Pana	10		100			
	Cassava	28		96	4		
	Other root crop						
Total		394					

14.2 The second column refers to the introduction of non-traditional planting material, either through extension or research, or from other sources.

14.3 For non-tree crops there are three types of spacing identified, being "customary", "regular" and "recommended". "Customary" means there is no discernable order in the plot. "Regular" means planting according to a visible pattern, such as in rows. "Recommended" refers to the adoption of recommended practices, which may not necessarily be "regular". For tree crops there are four categories of "customary", "regular", "triangular" and "square". "Customary" and "regular" follow the same rules as non-tree crops. "Triangular" and "square" equate with recommended practices for coconuts.

14.4 Crop mixtures in smallholder farming systems are complex, as seen in table 9.3. Table 14.2 describes something of the the complexity of planting densities. **44%** of coconut and **32%** of cocoa stands are monocropped, but complexity is exhibited in all crops. **34%** of sweet potato plots and **15%** of taro plots are essentially pure stand, but for the most part crops are grown in complex mixtures.

Table: 14.2
CROP DOMINANCE IN MIXTURES

crop type		number of observations	% dominance in mixture									
			0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 - 100
Cleared	Cleared land											
Coconut/Cocoa	Coconuts	16	6	6		19	13	6	6			44
	Cocoa	12				8	17	25		17		33
Ground crops	Grain crops	7	43	14	29						14	
	Beans	3	67			33						
	Cabbage	47	77	17	4	2						
	Vegetable	2	100									
	Chillie											
	Fruit Crops	39	49	21	8	5	5		5			8
Tree/other crops	Fruit trees											
	Banana	28	89	7	4							
	Citrus trees											
	Nut trees	2	100									
	Sugar cane	7	100									
	Food/building tree											
	Tobacco	5	60	20	20							
Root crops	Sweet potato	115	2		1	3	7	9	12	17	15	34
	Taro Common	48	25	17	13	2	13	2	4	4	6	15
	Giant	11	82	9								9
	Hong Kong	7	86	14								
	Swamp											
	Yam	7	43	14	29		14					
	Pana	10	20	10	10	20	20			10	10	
	Cassava	28	82	7	4						7	
	Other root crop											
Total		394										

14.5 A visual assessment of yields is presented in table 14.3.

Table: 14.3
CROP PRODUCTION

⟨--------- crop type ----------⟩		number of observations	⟨------- yield appearance (% obs) -------⟩ zero	low	moderate	high
Cleared	Cleared land					
Coconut/Cocoa	Coconuts	16		38	44	19
	Cocoa	12	8	33	33	25
Ground crops	Grain crops	7	29	14	43	14
	Beans	3				100
	Cabbage	47	2	38	30	30
	Vegetable	2	50		50	
	Chillie					
	Fruit Crops	39	18	38	23	21
Tree/other crops	Fruit trees					
	Banana	28	21	46	21	11
	Citrus trees					
	Nut trees	2	50	50		
	Sugar cane	7		100		
	Food/building tree					
	Tobacco	5			20	80
Root crops	Sweet potato	115	16	19	53	12
	Taro Common	48	19	23	56	2
	Giant	11		45	55	
	Hong Kong	7	43	29	29	
	Swamp					
	Yam	7	43	14	14	29
	Pana	10	30	10	30	30
	Cassava	28	11	43	36	11
	Other root crop					
Total		394				

14.6 Most crops show a range of yields, from low to high. There is a discernable seasonal pattern in yields in the survey area, where the months from May to October tend to be poor for sweet potato but good for taro, and conversely the months from November to April tend to be poor for taro but good for sweet potato. According to tradition taro is the preferred mid-year crop and there are corresponding seasonal changes in market supply and prices.

14.7 The appearance of coconut stands in the survey area was generally poor. Coconuts appear low yielding and little copra appears to be made. This may in part be due to the availability of other cources of employment and income in the survey area.

14.8 In an intensive case study of this kind it is difficult to obtain a reasonable coverage of crop yields, although these are recorded where possible in the course of the survey [12]. A crop production study has been designed to generate yield data [22] but it has not been possible to implement this yet. For the present report yields are derived from secondary sources.

a) COCONUT:

14.9 Coconut production data from the 1974-75 agricultural survey are summarised in table 14.4.

Table: 14.4
COCONUT PRODUCTION DATA FROM 1974-75 AGRICULTURAL SURVEY

	Province				Mean
	Western	Ysabel Central Guadalcanal	Malaita	Makira Temotu	Solomon Islands
number of yield sites	28	32	3	30	93
coconuts per palm: disciplined	53	54	19	34	44
customary	22	36	1	41	31
mean	31	42	14	37	36
coconuts per ha : disciplined	8,194	8,983	2,822	5,773	7,178
customary	4,658	8,595	135	7,432	6,703
mean	5,794	8,753	1,926	6,492	6,913
% damaged/unusable nuts: disciplined	12	10	12	20	14
customary	19	13	36	6	13
mean	16	12	12	13	14
gross copra yield (kg/ha): disciplined	1,541	1,689	531	1,086	1,450
customary	876	1,616	25	1,398	1,261
mean	1,081	1,646	362	1,221	1,300
net yield (kg/ha): disciplined	1,356	1,520	467	869	1,247
customary	709	1,406	16	1,314	1,097
mean	908	1,448	318	1,062	1,118

Source: Statistics Office (1978) "1974-75 Agricultural Statistics Survey".
Note: Copra yields assumse 190gm dried copra per nut quoted in the Statistics Office report

14.10 In the 1974-75 agricultural survey the mean coconut yield is estimated to be **1,300kg/ha** copra equivalent, or **1,118kg/ha** when unusable nuts are discounted. The average daily consumption of coconuts was found to be **4.2** per household, resulting in a national annual consumption equivalent of **8,871MT** copra. If green nuts are taken into account it was believed that the copra equivalent consumed would be **10,000MT**[5] in a year when exports amounted to **28,000MT**.

14.11 Charles (1980) estimates lower levels of copra production with estate yields of **827kg/ha** and smallholder yields of **410kg/ha** The difference he attributed to a high proportion of immature plantings and the consumption of coconuts in the smallholder sector[23]. Average copra production derived from the 1985 coconut survey is estimated in the (draft) Farm Management Handbook for Solomon Islands to be **0.72MT/ha**[24], although provincial yields vary from **1.15MT/ha** in Central Province, which is dominated by the Levers plantation in the Russel Islands, to **0.38MT/ha** in Temotu.

14.12 In conjunction with the 1985 coconut survey the Research Department of the Ministry of Agriculture and Lands has analysed the nutritient status of coconut soils soils in Solomon Islands[13]:

Coconut Soils Data:
(means of soils analyses conducted on Coconut Survey soils)

pH	N%	avaialble P ppm	exchangeable K meq/100g	avaialble K meq/100g
6.4	0.55	70	0.24	0.60

14.13 It was concluded that coconut soils are generally high in nitrogen, medium in phosphate, and low in potassium. Recent variety experimental results on fertilised coconuts show the following yields:

Coconut Research Results (dry copra eq kg/ha):

Site	Tenaru (Guadalcanal)		Gizo (Western)	
Year	1985	1984	1985	1984
Dwarf:Rennel Hybrid	378	2,664	1,990	1,599
Dwarf:Local Tall Hybrid	383	1,391		
Local Tall			1,830	334
Rennel	190	1,391	1,910	1,052
Mean				995

14.14 Only one smallholder yield for copra was obtained during the present survey in which the production was 2 bags per hectare or **140kg/ha.**

14.15 Smallholder yields in the present report are estimated to be **800kg/ha** dry copra equivalent usable nuts, of which **350kg** equivalent might be consumed.

b) <u>COCOA</u>:

14.16 Research trials on cocoa[13] from 1977 to 1985 at Black Post in Guadalcanal produced a mean dry beans yield of **1,898kg/ha** for Amelonado, **2,780kg/ha** for AmlxNa33 hybrid, and **2,444kg/ha** for AmlxPa7 hybrid.

14.17 Cocoa yields from various sources are quoted in the (draft) Farm Management Handbook for Solomon Islands[24]:

Smallholder Cocoa Yields (kg/ha)[24]:

Age of tree (year)	3	4	5	6	7	8
Friend (1970)	21	126	215	220	220	173
DBSI (1983) *	150	250	600	1,200	1,450	1,450
Hiele (1988)	208	450	560	685	719	719

* unverified source

14.18 High variability in yields was attributed to differences in management, such as in the application of fertiliser, weeding, and pest and disease control.

14.19 8 yield observations were made during the present survey resulting in a mean production of 7.14 bags/ha or **467kg/ha.**

14.20 Smallholder cocoa yields which are mainly unfertilised, are estimated in the present report to be **600kg/ha** dry beans.

c) **SWEET POTATO:**

14.21 In a study of north-west Malaita, Frazer[15] investigated the effect of fallow period on smallholder sweet potato yields. After a long fallow of 15-20 years the mean yield was found to be **14.84MT/ha** from 8 observations. After a "short" fallow of less than 10 years the mean yield was **8.99MT/ha** from 5 observations. Gollifer[16] looked at the effects of potassium and nitrogen application on annual crops on soils of the Dala Series in Malaita, soils formed on a parent material of raised coral reef and characteristically low in potassium. He found unfertilised sweet potato yields of **5.5MT/ha** (control for K) and **7.4MT/ha** (control for N). The effect of potassium application was to increase yields by up to 86%, but nitrogen tended to stimulate vine growth at the expense of the tuber.

14.22 In a series of trials at Dala, Gollifer[17] found unfertilised sweet potato yields to range widely, from around **0.25MT/ha** to **24MT/ha.** Yields in general were the order of **5MT/ha,** which was estimated to be around half the typical North West Guadalcanal yield of **9.97MT/ha.** Yield variability could not be attributed to variety or soil type, but a trend related to intensity of cropping did appear:

Effect of Recent Land History on Sweet Potato Yields (MT/ha):

land history	yield (MT/ha)
continuous cropping	3.51
0 - 4 years fallow	4.77
5 - 9 years fallow	6.03
more than 10 years fallow	9.29

Source: Gollifer (1969)

4.23 It was concluded that sweet potato and other root crops are demanding of, and remove large quantities of, potassium from the soil. A fallow-burn cycle is therefore essential to replenish soil fertility by making potassium available to shallow-rooted crops. It was considered that deep rooting trees may act as nutrient pumps, but the only practical way of shortening fallow periods was considered to be the application of potassium fertiliser[17].

4.24 Bathgate[18] found also that yields vary according to soil fertility and growing time, as well as species and density of planting. In West Guadalcanal he quotes sweet potato yields of **7.16MT/ha** after 20 years of fallow and **9.36MT/ha** after 8 years of fallow, but based on a single sub-plot observation only in each case.

4.25 On the weather coast of Guadalcanal Chapman and Pirie[19] studied the relationship between yields and cropping, and found yields to be high in comparison to studies elsewhere:

Sweet Potato Yield (MT/ha) - Weather Coast, Guadalcanal

successive crops	Ghauvalisi	Sughu	Hatare/Poinaho
1	41.67	18.08	17.82
2	15.31	10.54	9.79
3		10.29	9.79

Source: Chapman and Pirie (1974)

14.26 In the 1974-75 Agricultural Survey[5] the mean yield of sweet potato was 15.7MT/ha, but this was felt to be an over-estimate.

14.27 More recent research provide further information on sweet potato yields, but results exhibit considerable variability across seasons and due to other causes:

trial	yield MT/ha		notes
	gross	marketable	
improved cultivars	17.9	14.5	25 obs
control	11.2	6.7	1 obs
dry season corn intercropping	15.9	7.1	135 days to harvest
	18.5	12.0	165 days to harvest
wet season corn intercropping	5.9	1.5	135 days to harvest
	11.0	3.4	165 days to harvest
dry season weevil control	15.3		no effect from insecticide
wet season weevil control	8.19	6.37	

Source: Research Department Annual Report 1984[14] and 1985[13]

14.28 10 yield observations were made on sweet potato during the present survey resulting in a mean yield of 9,081kg/ha.

14.29 Smallholder sweet potato yields of usable crop are estimated in the present report to be 8MT/ha under long fallow of 8 years or more - falling to 5MT/ha for fallow of 4 to 8 years, and 3.5MT/ha for short fallow cropping.

d) TARO:

14.30 Taro yields in the literature are highly variable. Frazer[15] found Colocasia esculenta to yield 8.94MT/ha in North Malaita, based on 10 observations. Gollifer[16] on the Dala Series in Malaita found yields of 4.0MT/ha for unfertilised taro, which increased to 6.0MT/ha with 168kg/ka potassium fertiliser applied. Gollifer[17] also quotes widely ranging unfertilised taro yields of 1.00 to 10.80MT/ha on experimental plots. In a spacing trial in Guadalcanal at Tenaru on which fertiliser was applied, the net undamaged taro yield for densities of 2,000 to

4,000 plants/ha was around **5MT/ha**, with 30% loss due to corm damage[14]. On the same site a high intensity inputs and management trial to investigate leaf blight yielded around **9MT/ha** marketable corms[14]. The control yield in a 1985 taro beetle trial at Tenaru was **3.49MT/ha**[13]. Tioti (1967) estimated taro yields to be **12.6MT/ha**[25], but Gollifer (1970) quotes yields of **4.7MT/ha**[26].

14.31 One yield observation was made on Hong Kong taro, but on a sub-plot of only 3 square meters which had a yield of 9 kg. This would result in a yield of **30,000kg/ha**, however, it is not valid to aggregate in this simple way from such a small sub-plot.

14.32 The smallholder taro yield in the present report is estimated to be **5MT/ha**.

e) <u>YAM</u>:

14.33 In North Malaita Frazer[15] found yam yields of **5.16MT/ha** for <u>Dioscorea alata</u>. Gollifer[17] quotes unfertilised yam yields of **6.03MT/ha** to **30.38MT/ha** at Dala experimental station on Malaita. In 1984 an experiment to compare the yields of 18 yam cultivars was conducted at Tenaru in Guadalcanal[14] in which the cultivars with high resistance to dieback yielded around **14** to **18MT/ha**, with the highest resistance cultivar yielding **24MT/ha**. Susceptible cultivars produced yields as low as **2MT/ha**. Maeinia[27] quotes very high yields of **50 - 63MT/ha** for Malaita.

14.34 Smallholder yam yields are likely to be higher than those of sweet potato given that they tend to be planted on newly opened sites and the yield appearance is generally good. In the present report long term fallow is expected to yield **10MT/ha**, fallow of 4-8 years to yield **6MT/ha** and short fallow systems to yield **4MT/ha**.

f) **PANA**:

14.35 Frazer[15] quotes a for North Malaita, where on one observation only of Dioscorea esculenta produced a yield of **11.52MT/ha**. Fertilised cultivar trials at Dodo Creek Research Station[14] in 1984 yielded **16.2MT/ha** marketable tubers out of a total yield of **27.7MT/ha**. 1983 results were higher, with **43.7MT/ha** marketable tubers out of a total yield of **52.9MT/ha**. The difference was believed to be due to inadequate fertiliser in 1984. In 1985 the mean fertilised yield of 8 cultivars was **24.3MT/ha** marketable tubers[13].

14.36 Smallholder pana yields in the present report are expected to be similar to yam yields - of **10MT/ha** under long fallow, **6MT/ha** under 4-8 years fallow, and **4MT/ha** under short fallow.

g) **CASSAVA**:

14.37 Fertilised cassava in a time of harvest trial at Dodo Creek in Guadalcanal[13] yielded **23.8MT/ha** after 9 months and **27.8MT/ha** after 12 months. In a fertilised germplasm collection trial on the Fataolo land system on Malaita 17 cultivars ranged from 7.5 to **65.8MT/ha**, with 50% above 40MT/ha[28].

14.38 Smallholder cassava is generally planted on less fertile sites and is commonly a minor crop in a mixture. It is high yielding, although of low nutritional value. Smallholder yields in the present report are estimated to be **10MT/ha**.

h) **MAIZE**:

14.39 Gollifer[16] quotes unfertilised maize yields of **1.90MT/ha** on Dala soils in Malaita, but yields of **5.58MT/ha** when fertilised with NPK. Further unfertilised maize yield data from Dala[17] range from **1.55MT/ha** to **2.13MT/ha**.

14.40 Smallholder maize yields in the present report are estimated to be **1.8MT/ha**.

i) **GROUNDNUT**:

14.41 Gollifer quotes unfertilised groundnut yields in the range **527kg/ha** to **1,278kg/ha** from Dala in Malaita.

14.42 Smallholder groundnut yields in the present report are estimated to be **600kg/ha.**

j) **BEANS**:

14.43 One yield observation on snake bean was made in the present survey, with a yield of **213kg/ha.**

k) SUMMARY OF YIELDS:

14.44 Crop yields derived fromthe survey and secondary sources are necessarily imprecise because of the complexity of smallholder farming systems. Diverse crop mixtures, with varying crop densities and differing site conditions do not lend themselves to a simple analysis of crop yields or smallholder production. Crop yields in the literature are generally for pure stand crops, or very simple mixtures - under controlled or even modified conditions. There is then a need to study smallholder production under more realistic conditions, as is part of the on-going programme of the Agricultural Economics Section. In the meantime, a "best estimate" of typical smallholder yields in the project area is presented in table 14.5.

Table: 14.5
SMALLHOLDER CROP YIELDS

crop	condition	yield kg/ha
coconut	copra equivalent	800
cocoa	dry beans	600
sweet potato	> 8 years fallow	8,000
	4 - 8 years fallow	5,000
	< 4 years fallow	3,500
taro		5,000
yam	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
pana	> 8 years fallow	10,000
	4 - 8 years fallow	6,000
	< 4 years fallow	4,500
cassava		10,000
maize		1,800
groundnuts		600

Chapter: 15
SMALLHOLDER PRODUCTION

15.1 Under the Rural Services "Project Benificiary Monitoring and Evaluation" undertaken by the Statistics Office, gross crop offtake and other primary production were measured on six of the Rural Development Centre sites. The closest site on Malaita is at Afio. Results are not representative of conditions at Fote and so are not presented here.

15.2 From table 9.2 the average root crop area in the survey area is **0.832ha** of which sweet potato is dominant on **0.210ha** and taro on **0.016ha**. All crops occur in complex mixtures, so that simple cropping patterns can only be used as a first approximation for the actual crop coverage.

15.3 Table 15.1 is a summary of available production data from the farming systems survey. It is not possible to directly relate aggregate production data to average cropping patterns until a more detailed analysis of smallholder production is available.

Table: 15.1
SMALLHOLDER PRODUCTION SUMMARY

commodity	area (ha)	growing period (months)	annual production (kg)
sweet potato	0.210	4.3	
cassava	0.003	7.5	
yam	0.002	8.5	
pana	0.003	7.4	
taro	0.016	7.4	
breadfruit			
banana			
Source table:	9.2	11.3	

Chapter: 16
LABOUR

16.1 With little or no cash inputs applied the main component in the socio-economy of smallholder agriculture is labour. Table 16.1 presents an overview of labour constraints expressed by farmers. The first part of the table shows the frequency of gardens affected and is expressed in terms of area affected in the second part. Labour constarints are illustrated in diagram 16.1.

Table: 16.1
LABOUR CONSTRAINTS

i) Labour Constraints by number of observations (gardens)

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		5		45	50
lack of labour		4		4	8
lack of inputs/cash		1		9	10
lack of labour + cash		8			8
garden too far from house					
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		18		58	76

ii) Labour Constraints by % area

crop type:	cleared land	tree crops	short term cash crops	food crops	all crops
no limitation		13		26	39
lack of labour		6			6
lack of inputs/cash				3	3
lack of labour + cash		52			52
garden too far from house					
garden too far + labour					
garden too far + cash					
too far + labour + cash					
total by crop type		71		29	100

Note: The table of % area is only approximate due to rounding small numbers

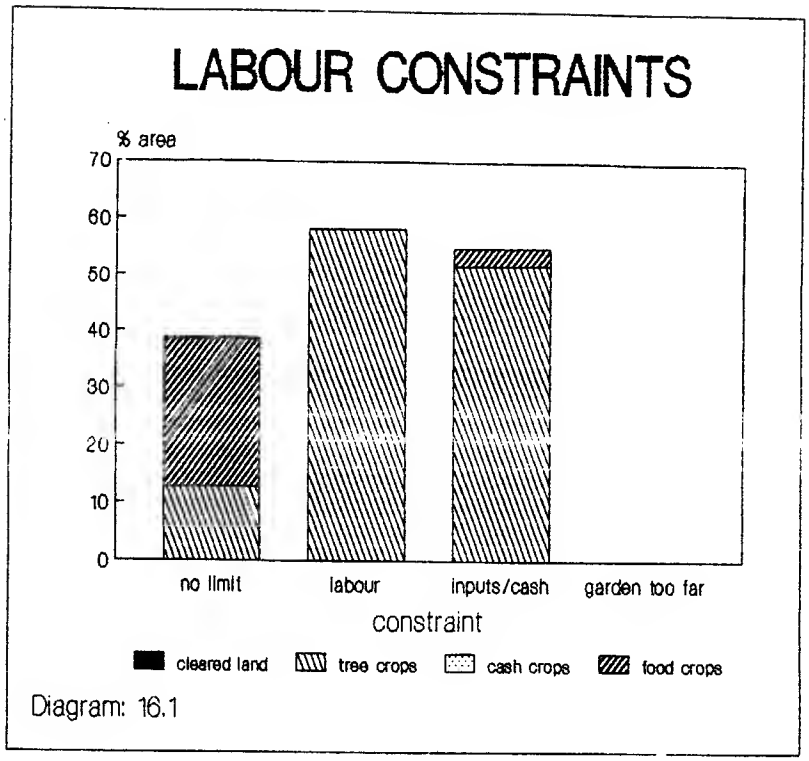


Diagram: 16.1

16.2 The dominant constraint is labour on tree crops. A labour shortage is recorded on **82%** of the tree crop area, while a shortage of inputs or cash is recorded on **73%** of the area. In contrast **10%** of the food crop area is affected by a shortage of inputs or cash only. Distance of gardens from households is not a problem.

16.3 Table 16.2 summarises the labour requirements of the average holding, derived from individual plot labour studies presented in annex 2. The table is a "model" budget representing the average of complex and diverse holdings. Individual crop budgets in annex 2 may be used to construct farm budgets for hypothetical holdings, but caution should be exercised where there are few observations. Labour days in budgets presented here are based on actual hours worked per day, which are quite variable. Again, tables in annex 2 may be used to convert work hours into "standard" work days if required. Since table 16.2 represents the average holding, crops which comprise only minor mixtures in cropping patterns do not appear in the summary labour budget.

16.4 The table shows the labour requirement of each agricultural operation according to crop, which may be a pure stand or more commonly the dominant crop in a mixture. Agricultural operations cover: land clearance; cultivation; planting; first, second and third weeding; and harvesting. For some crops - notably, but not exclusively, trees - there may be additional operations such as pruning or thinning which do not easily fall within the standard classification. Two general categories of establishment and maintenance operations are therefore included. Such a classification provides good coverage for most activities and allows diverse crops to be handled in a standard manner.

16.5 In the interpretation of labour budgets it should be remembered that only tree cropping farmers will require labour on tree crops while non-tree cropping farmers will not require any. Labour budgets are also presented on the basis of labour input "when operations are performed". Adjustment is not made to the labour input to take account of operations which are omitted. By referring to annex 2 adjustments may be made to budgets based on different assumptions about management intensity. Incorporating this into the present analysis would considerably increase the complexity of presentation and introduce ambiguity into the results.

Table: 16.2

ANNUAL LABOUR INPUT BY HOLDING

	(------ work days per year -----) (----- per holding -----)				per ha	(- % contribution -)			labour cost
	men	women	paid	total	average	men	women	paid	(SI$)
i) Land Clearance									
Cleared land	2			2	104	100			
Coconut	76	25		101	224	75	25		
Cocoa	1	1	6	8	69	13	13	75	7
Grain crops					39				
Fruit crops					52				
Sweet Potato	25	26	4	55	264	45	47	7	13
Taro		1		1	124		100		1
Yam					72				
Pana					38				
Total holding	104	53	10	167	187	62	32	6	21
ii) Cultivation									
Cleared land									
Coconut									
Cocoa	7			7	60	100			
Grain crops					154				
Fruit crops									
Sweet Potato	23	32	1	56	266	41	57	2	3
Taro	2			2	177	100			
Yam					91				
Pana					67				
Total holding	32	32	1	65	225	49	49	2	3
iii) Planting									
Cleared land									
Coconut	51	17		68	149	75	25		
Cocoa	3	1	2	6	55	50	17	33	4
Grain crops					154				
Fruit crops					32				
Sweet Potato	9	44	1	54	251	17	81	2	1
Taro	1			1	65	100			
Yam					113				
Pana					107				
Total holding	64	62	3	129	181	50	48	2	5

ANNUAL LABOUR INPUT BY HOLDING (continued)

	⟨------ work days per year -----⟩					⟨- % contribution -⟩			labour
	⟨----- per holding -----⟩				per ha				cost
	men	women	paid	total	average	men	women	paid	(I)
iv) Establishment									
Cleared land									
Coconut									
Cocoa	5			5	46	100			
Grain crops									
Fruit crops									
Sweet Potato									
Taro									
Yam									
Pana									
Total holding	5			5	46	100			
v) Maintenance									
Cleared land									
Coconut	8			8	18	100			6
Cocoa	4	1		5	46	80	20		
Grain crops									
Fruit crops									
Sweet Potato									
Taro									
Yam									
Pana									
Total holding	12	1		13	34	92	8		6
vi) First Weeding									
Cleared land									
Coconut	15	15		30	65	50	50		
Cocoa	3		1	4	39	75		25	3
Grain crops					154				
Fruit crops					26				
Sweet Potato	8	40		48	228	17	83		
Taro	3	2		5	309	60	40		
Yam					128				
Pana					160				
Total holding	29	57	1	87	198	33	66	1	3

ANNUAL LABOUR INPUT BY HOLDING (continued)

	work days per year per holding men	women	paid	total	per ha average	% contribution men	women	paid	labour cost (SI$)
vii) Second Weeding									
Cleared land									
Coconut	28	9		37	84	76	24		
Cocoa	5			5	43	100			
Grain crops					154				
Fruit crops									
Sweet Potato	6	38		44	208	14	86		
Taro		2		2	118		100		
Yam					163				
Pana					40				
Total holding	39	49		88	171	44	56		
viii) Third Weeding									
Cleared land									
Coconut									
Cocoa	5			5	43	100			
Grain crops									
Fruit crops	2			2	169	100			
Sweet Potato	28	28		56	268	50	50		
Taro		2		2	147		100		
Yam									
Pana									
Total holding	35	30		65	175	54	46		
ix) Harvesting									
Cleared land									
Coconut									
Cocoa	10	4		14	123	71	29		
Grain crops									
Fruit crops									
Sweet Potato		170		170	810		100		
Taro		6		6	368		100		
Yam	1	1		2	542	50	50		
Pana									
Total holding	11	181		192	759	6	94		

16.6 Coconuts account for 60% of the labour expended in land clearance, requiring 101 work days per year. Cocoa accounts for a further 5% of labour expended. Taro and sweet potato, the dominant root crops, require 56 work days per year, accounting for 34% of labour on land clearance. On a unit area basis the labour requirement of sweet potato is about the same as that of coconut. Sweet potato accounts for 264 work days per hectare compared with 224 workdays per hectare on coconuts. Men contribute most labour on land clearance, particularly on tree crops. Of 167 work days, men contribute 62%, women 32% and 6% of labour on land clearance is hired, mainly on cocoa but also on sweet potato.

16.7 Sweet potato dominates the labour budget on cultivation, requiring 56 work days compared with 7 days on coconuts. Of 65 work days per year men contribute 49% and women 49%. 2% of labour on cultivation is hired. Among sampled households men are responsible for the cultivation of cocoa and taro, while work is shared between men and woment on sweet potato.

16.8 53% of the labour expended in planting is on coconuts, accounting for 68 work days per year, with a further 6 work days on cocoa. Root crops account for 43% of labour expended on planting, requiring 55 work days. Of 129 work days per year required on planting men contribute 50% and women contribute 48%. 2% of labour is hired, mainly on cocoa. Men perform most of the planting of coconuts and cocoa, and the planting od taro, while women are mainly responsible for the planting of sweet potato and assist with tree crops.

16.9 5 days per year are worked by men on the establishment and tending of cocoa. 13 work days are spent per year on the maintenance of coconut and cocoa plantings where men provide 92% of the labour input and women 8%.

16.10 87 work days are spent on the first weeding of crops, of which 34 days are accounted for by coconuts and cocoa, and 53 days by root crops. Labour is predominantly supplied by women, who contribute 66% of the labour on first weeding compared with 33% from men and 21 from hired labour. Men and women take equal shares of the brushing of coconuts but men provide most of the labour on cocoa and taro. Women provide most of the labour on the weeding of sweet potato.

16.11 88 work days are spent on the second weeding of crops, of which 42 days are on coconuts and cocoa, and 46 days are on root crops. Men and women provide about equal shares of the labour on second weeding. Men perform most of the weeding on tree crops while women are largely responsible for root crops.

16.12 65 work days are spent on third weeding, of which men and women contribute about equal shares.

16.13 192 work days are spent on harvesting, mostly by women. Men account for 6% of labour in harvesting compared with 94% from women. Women provide most of the labour on harvesting root crops and provide 29% of the labour on cocoa. Women provide 181 harvesting labour days to 11 days from men.

16.14 Overall men provide 41% of labour, women provide 57% and 2% is hired. Men are particularly concerned with the expansion of cropping and the establishment of coconuts, cocoa and taro where they provide most labour on land clearance, cultivation, establishment and maintenance. Women provide most labour on sweet potato gardens and in the weeding and harvesting of crops.

16.15 Table 16.3 presents a summary of labour by crop and by operation

16.16 Overall there are 811 work days per year required on an "average" holding of which 331 are provided by men, 465 by women and 15 by hired labour at an annual cost of SI$38. The average adult man in the household spends 161 days working on the holding and the average adult woman spends 245 days, with an additional 15 days of hired labour.

16.17 Men contribute 41% of farm labour, women provide 57% and 2% is accounted for by hired labour.

Table: 16.3

SUMMARY OF LABOUR INPUT

	(------ work days per year -----) (----- per holding -----)				per ha	(- % contribution -)			labour cost
i) By Crop	men	women	paid	total	average	men	women	paid	(SI$)
Cleared land	2			2					
Coconut	178	66		244	540	73	27		6
Cocoa	43	7	9	59	524	73	12	15	14
Grain crops					655				
Fruit crops	2			2	279	100			
Sweet Potato	99	378	6	483	2295				17
Taro	6	13		19	1308	32	68		1
Yam	1	1		2	1109	50	50		
Pana					412				
All Crops	331	465	15	811		41	57	2	38
ii) By Operation									
Land Clearance	104	53	10	167		62	32	6	21
Cultivation	32	32	1	65		49	49	2	3
Planting	64	62	3	129		50	48	2	5
Tree Crops Establishment	5			5		100			
Tree Crops Maintenance	12	1		13		92	8		6
First Weeding	29	57	1	87		33	66	1	3
Second Weeding	39	49		88		44	56		
Third Weeding	35	30		65		54	46		
Harvesting	11	181		192		6	94		
All Operations	331	465	15	811		41	57	2	38
Available labour units	:2.05	1.90							
Days per unit labour	: 161	245	15						

16.18 Labour by crop is illustrated in diagram 16.2. Coconuts account for **30%** of the holding labour budget and cocoa **7%**. Coconuts require of **244** work days per year and cocoa **59** days. Sweet potato requires **483** work days per year and taro **19** days. Overall food crops account for **62%** of the annual labour budget. Men provide **73%** of the labour on coconuts and cocoa and around one third of the labour on root crops. Women provide **27%** of the labour on coconuts, **12%** on cocoa and about two thirds of the labour on root crops.

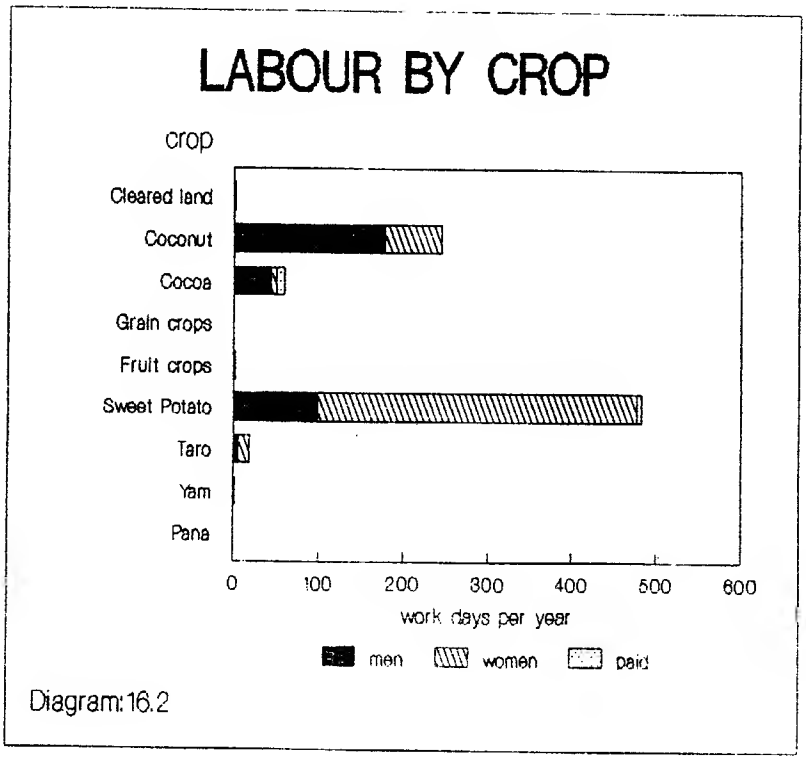


Diagram:16.2

16.19 Labour by operation is illustrated in diagram 16.3. Men and women contribute fairly equal amounts of labour on the main operations, although women provide **94%** of the labour on harvesting.

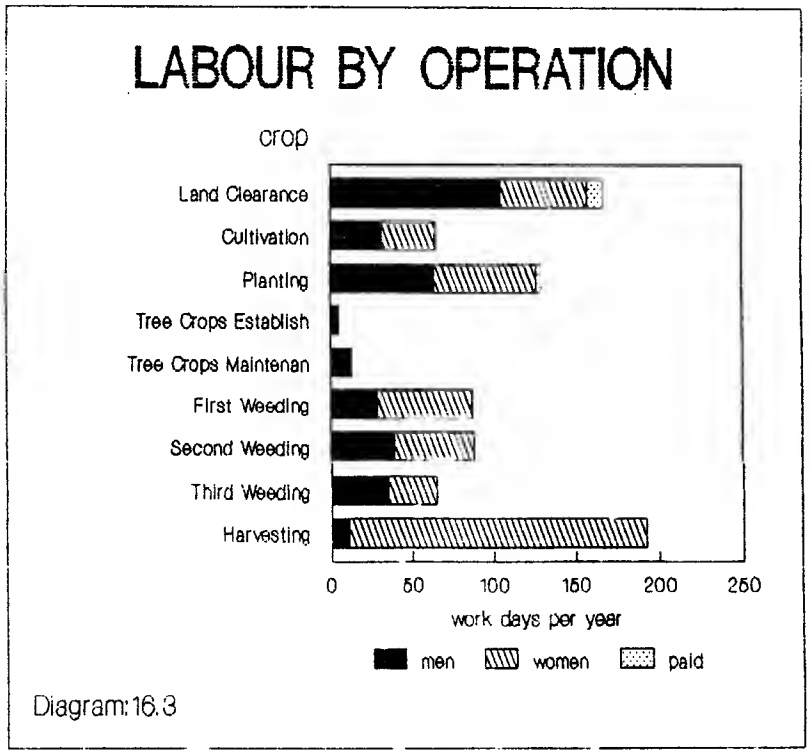


Diagram: 16.3

16.20 Diagram 16.4 illustrates the contribution from men, women and hired labour. Men contribute **41%** of labour on farm, women provide **57%** and **2%** is hired.

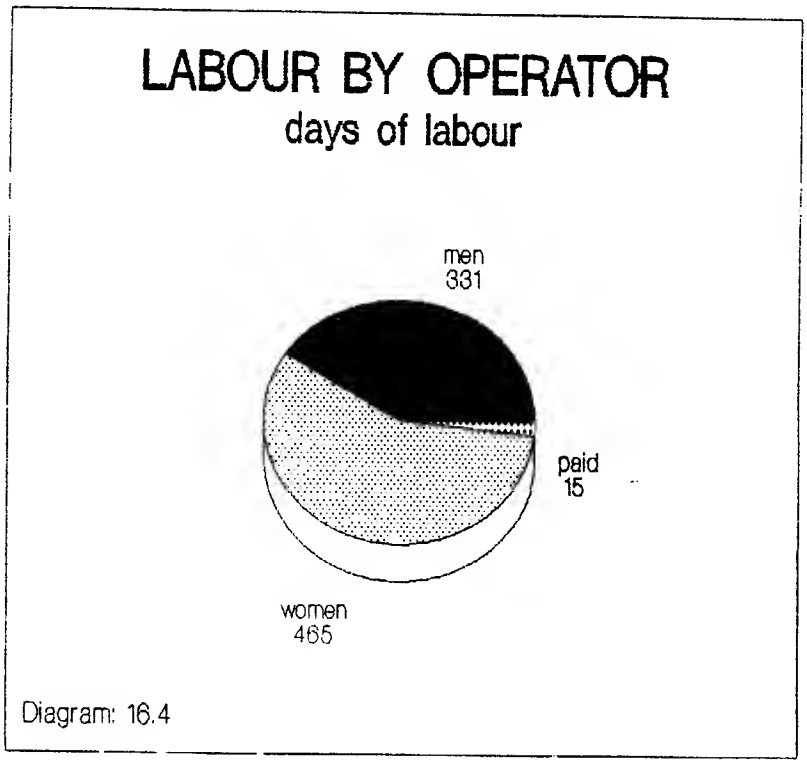


Diagram: 16.4

Chapter: 17
CROP AND FARM BUDGETS

17.1 It is not possible at this stage to produce comprehensive crop and farm budgets because of the complexity and diversity of cropping patterns, and production data are as yet incomplete. The main elements are available and a summary of information on cropping patterns, production and labour is presented in Table 17.1.

Table: 17.1
ELEMENTS OF A FARM BUDGET

main crop in mixture	area (ha)	annual production (kg)	annual labour	
			work days	cost (SI$)
a Cleared Land	0.024		2	
b Coconut	0.451		244	6
c Cocoa	0.111		59	14
d Pasture				
e Grain Crops	0.001			
f Beans				
g Cabbage				
h Vegetables				
i Spices				
j Fruit Crops	0.013		2	
k Fruit trees				
l Banana				
m Citrus trees				
n Nut trees				
o Sugar cane				
p Food/building tree				
q Tobacco				
r Sweet Potato	0.210		483	17
s Taro	0.016		19	1
t Yam	0.002		2	
u Pana	0.003			
v Cassava	0.003			
w Other root crop				
Total	0.832		624	17
Table reference	9.2	not available	16.3	16.3

Chapter: 18
CASH CROP PROCESSING

18.1 Table 18.1 presents a labour budget for the production of copra based on 2 observations. The labour composition is **96%** family and **4%** hired, at an annual cash cost of **SI$3.0**. Hired labour is employed for axing and extracting the coconut meat with a copra knife while all operations are performed by family labour.

18.2 Copra manufacture is labour intensive, requiring **34** work days per annum to produce **254kg** copra, or one work day per **8kg** copra produced. **21** work days are spent on shelling the nuts which account for **62%** of the total production time. Firewood collection takes **5** days or **15%** of the time; and drying, bagging and transport take 8 days or **24%** of the time. The annual labour input is illustrated in diagram 18.1.

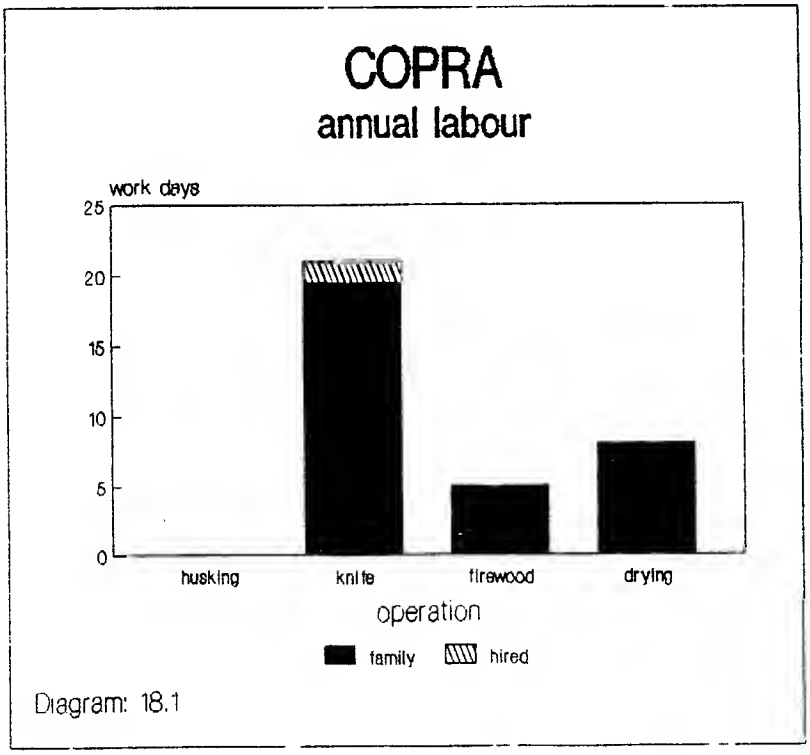


Diagram: 18.1

Table: 18.1

ANNUAL COPRA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		work hours	work days	work days	cash cost ($.c)	work days	
HUSKING	picking, heaping						
	husking						
	transport						
	breaking						
	shelling						
	total						
COPRA KNIFE	picking, heaping	54.0	13.5			13.5	40
	axing + copra knife	16.0	2.0	1.5	3.00	3.5	10
	transport	14.0	4.0			4.0	12
	total	84.0	19.5	1.5	3.0	21.0	62
FIREWOOD	collection	14.0	2.5			2.5	7
	transport	14.0	2.5			2.5	7
	collection + transport						
	total	28.0	5.0			5.0	15
DRYING	drying	35.0	5.0			5.0	15
	bagging	6.0	1.5			1.5	4
	transport	4.5	1.5			1.5	4
	total	45.5	8.0			8.0	24
TOTAL		157.5	32.5	1.5	3.0	34.0	100
% labour by type of labour			96	4		100	

copra grade	quantity of copra produced (kg)	
	per annum	per work day
Grade 1	254	8
Grade 2		
Grade 3		
Ungraded		
total	254	8

Number of observations = 2

18.3 The gross margin for copra production is summarised in table 18.2. From an annual production of **254kg** valued at the prevailing price of 33 cents per kilo the gross return is **SI$84.** Inputs costs from bags and twine amount to **SI$7.08** and labour costs are **SI$3.00.** The net income is **SI$77** which, at a requirement of 33 household labour days, represents a net return to labour of **SI$2.33** per household work day.

Table: 18.2
COPRA GROSS MARGIN

Annual production (kg)	254
Price per kilogram (SI$)	0.33
Gross return (SI$)	84
Inputs cost (SI$)	4.08
Labour cost (SI$)	3.00
Net return (SI$)	77
Household labour days	33
Copra production per household work day (kg)	8
Net return per household work day (SI$)	2.33

Inputs costs: Sacks @ SI$1.00 per new sack;
Average packed weight 70kg = 4 sacks = SI$4.00.
Twine @ SI$1.00 per hank of 50 strings = SI$0.08.

18.4 Table 18.3 presents the budget for cocoa production undertaken by 8 sampled farmers.

Table: 18.3
ANNUAL COCOA PRODUCTION AND LABOUR EXPENDITURE

Annual Labour Expenditure		family or shared labour		hired labour		total	% labour by operation
		hours	work days	work days	cash cost ($.c)	work days	
FIELD	harvesting	13.5	2.6			2.6	40
	breaking pod	8.1	2.3			2.3	34
	transport	5.5	1.5			1.5	23
	total	27.1	6.4			6.4	96
FIREWOOD	collection						
	transport						
	collection + transport						
	total						
DRYING	fermenting						
	drying						
	bagging	1.0	0.3			0.3	4
	transport						
	total	1.0	0.3			0.3	4
TOTAL		28.1	6.6			6.6	100
% labour by type of labour			100			100	

cocoa	quantity of cocoa produced (kg)	
	per annum	per work day
Wet beans	72	11
Dry Beans		
total	72	10.9

Number of observations = 8

18.5 6.6 work days were expended in the production of only 72kg wet beans. Labour expenditure in the production of cocoa is illustrated in diagram 18.2.

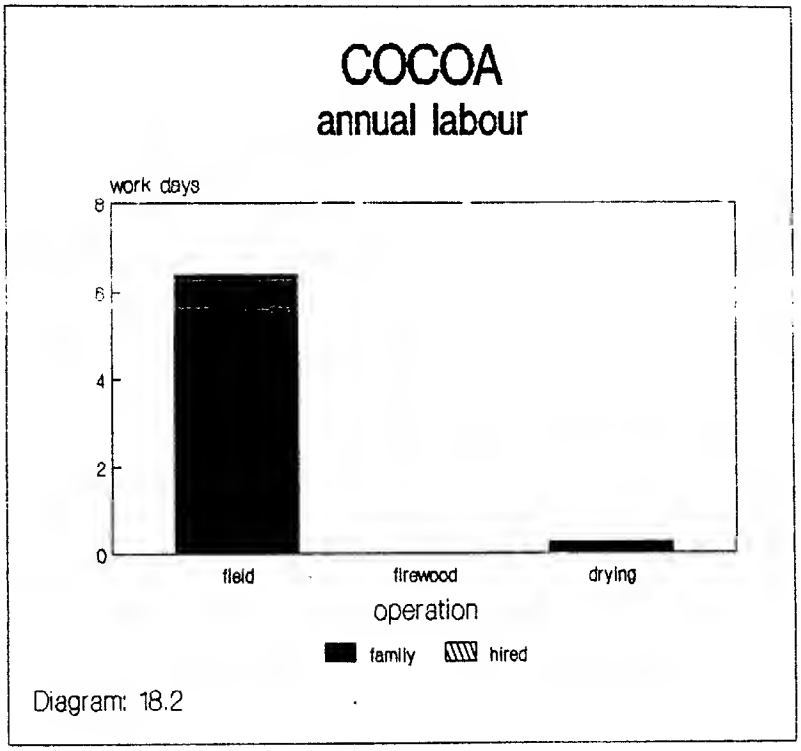


Diagram: 18.2

18.6 The gross margin for cocoa is shown in table 18.4. An annual production of **72kg** of cocoa at the prevailing price of SI$0.70 per kilo wet beans provides a net return of **SI$49**, representing a return to labour of **SI$7** per family day worked.

Table: 18.4
COCOA GROSS MARGIN

Annual production (kg)	72
Price per kilogram (SI$)	0.70
Gross return (SI$)	50
Inputs cost (SI$)	1.02
Labour cost (SI$)	0
Net return (SI$)	49
Household labour days	7
Cocoa production per household work day (kg)	10
Net return per household work day (SI$)	7

Inputs costs: Sacks @ SI$1.00 per new sack;
Average packed weight 65kg = 1 sacks = SI$1.00;
Twine @ SI$1.00 per hank of 50 strings = SI$0.02.

Chapter: 19
MARKETING

19.1 Table 19.1 presents a summary of marketing data collected in the survey, listing crops marketed against the number of observation recorded. The mean weight marketed is recorded, the time taken to go to market and back, the number of times the commodity is marketed per year, and the number of people involved in marketing. These are grouped under the heading of "marketing" details.

19.2 Marketing costs are recorded under the headings of freight or transport costs, fares for people involved in marketing, and market tax which may be imposed at the point of sale.

19.3 Revenues are possible where wages are earned, for instance from selling other farmers' produce and from the sale of crops. It is often difficult for sellers to specify costs and revenues, and in such cases data have to be treated as "missing". Thus the number of observations for crop sales may be lower than those for marketing data.

19.4 Table 19.2 is a transformation of the raw marketing data into an "average" annual marketing budget. The data are incomplete because of difficulties in recalling weights sold and marketing revenues. It is presented not as a model marketing budget, but as a data set to provide as much information on marketing as possible, albeit with gaps.

19.5 The two right-most columns show the net marketing revenue by crop and by household. The "net marketing revenue by crop" is the net return from sales after deducting costs. It is not the average income from crop sales since revenue may be negative where income data are missing or as a result of the double counting of transport costs when freight expenses are shared among several crops.

19.6 The "net marketing revenue per household" is the average household earnings taking account of the proportion of households selling each type of crop, but based on the limitations of the crop revenue data.

Table: 19.1
MARKETING TIME AND CROP PRICES

Basic Marketing Data:

		(---------- marketing ----------)					(--------- costs --------)			(-- revenues --)		
		number of obs	mean weight marketed	time to market and back	times marketed per year	number of people	freight/ transport cost	fares for people	market tax	wages earned	crop sale price	crop sale obs
		(obs)	(kg)	(days)	(times)	(people)	(I)	(I)	(I)	(I)	($/kg)	(obs)
ALL CROPS	Average	54	40	0.9	13	1	0.66	0.97	0.19	0.85	0.82	55
COCONUT	Coconut	5	64	1.0	18	1	2.24	1.64	0.20		0.25	5
	Copra	2	253	1.0	2	1	7.50	1.50			0.42	2
COCOA	Pods	1	70		12	1				4.00	0.50	1
	Green beans	7	23	0.4	23	1					0.59	7
ROOT CROPS	Sweet Potato	21	30	1.0	14	1	0.29	1.33	0.26	1.90	0.44	21
	Common Taro	3	61	1.0	2	1	0.33	2.00	0.17		0.66	3
	Yam	1	25	1.0	1	1					0.24	1
	Pana	1	25	1.0	1	1					0.24	1
	Cassava	3	17	1.0	16	1		0.80	0.33		0.18	3
BEANS	Beans	1	1	1.0	24	1					0.50	1
VEGETABLE	Hibiscus Cabbage	4	22	0.8	5	1	0.20	0.40	0.20	0.40	0.72	5
	Tomato	1	1	1.0	8	1				1.00	1.67	1
FRUIT CROPS	Pineapple	1	18	1.0	3	1	1.00	2.00	0.50		0.06	1
	Banana	1	15	1.0	4	1					0.27	1
	Paw Paw	1		1.0							0	
NUT TREES	Betel Nut	1	0	1.0	4	1	1.00	2.00	0.50		20.00	1
Number of households		38										

Table: 19.2
INCOME FROM MARKETING

Annual Marketing Budget:

					costs (SI$)				revenues (SI$)				
		% houses marketing crop	weight marketed	man days	freight/ transport cost	fares for people	market tax	total marketing costs	wages earned	crop sales	total revenue	net marketing revenue by crop	net marketing revenue per household
		(%)	(kg)	(days)	(SI$)	(SI$)	(SI$)	(SI$)	(SI$)	($/kg)	(SI$)	(SI$)	(SI$)
ALL CROPS	Average		561	11.5	6	12	2	23.07	11	413.11	423.92	401	230
COCONUT	Coconut	13	1139	17.8	40	29	4	72.62		284.80	284.80	212	28
	Copra	5	380	1.5	11	2		13.50		158.29	158.29	145	8
COCOA	Pods	3	840						48	420.00	468.00	468	12
	Green beans	18	548	5.8						325.92	325.92	326	60
ROOT CROPS	Sweet Potato	55	421	18.7	4	19	4	26.33	27	185.92	212.59	186	103
	Common Taro	8	140	2.3	1	5	0	5.75		93.27	93.27	88	7
	Yam	3	25	1.0						6.00	6.00	6	0
	Pana												
	Cassava	8	277	16.0		13	5	18.13		48.72	48.72	31	2
BEANS	Beans	3	24	24.0						12.00	12.00	12	0
VEGETABLE	Hibiscus Cabbage	11	120	2.6	1	2	1	4.32	2	86.83	88.99	85	9
	Tomato												
FRUIT CROPS	Pineapple	3	54	3.0	3	6	2	10.50		3.00	3.00	-7	0
	Banana	3	60	4.0						16.00	16.00	16	0
	Paw Paw	3											
NUT TREES	Betel Nut	3	1	4.0	4	8	2	14.00		20.00	20.00	6	0

19.7 Table 19.3 shows the time taken to different markets and the type of crop sold at each market. The classification of markets is subject to local interpretation, where "central" would generally be the provincial capital.

Table: 19.3
MARKET LOCATION

	market location:	local	inter-mediate	central	Honiara	% obs	number of obs
i) Time taken to market produce							
	time taken to go to market and back (days)		(% observations)				
	0 - .5	9	2			11	6
	.5 - 1	22	16	51		89	49
	1 - 2						
	2 - 5						
	5 - 10						
	> 10						
	% observations	31	18	51		100	
	number of observations	17	10	28			55
	mean time (days)	1.00	1.00	1.36	5.20		1.75
ii) Crops sold at different markets			(% observations)				
COCONUT	coconut			9		9	5
	copra			4		4	2
COCOA	pods	2				2	1
	wet beans	9	4			13	
ROOT CROPS	sweet potato	7	7	24		38	31
	common taro		2	4		5	5
	yam	2				2	1
	pana	2				2	1
	cassava		2	4		5	3
BEANS	beans		2			2	2
CABBAGE	cabbage	5		4		9	5
VEGETABLE	tomato	2				2	1
FRUIT CROPS	pineapple			2		2	2
	paw paw	2				2	
	banana		2			2	1
NUT TREES	betel nut			2		2	1
	% observations	31	18	51		100	
	number of observations	17	10	28			55

19.8 Table 19.4 summarises crop price perception and sale volumes.

Table: 19.4
CROP PRICE PERCEPTION AND SALE VOLUMES

		(---- sale price ----)			(----- sale volume -----)			number of obs
		poor	average	good	little	average	more than usual	
COCONUT	Coconut		60	40	40	60		5
	Copra	50		50		100		2
COCOA	Pods		100			100		1
	Dry Beans	57	43		14	86		7
ROOT CROPS	Sweet Potato	5	67	29	38	62		21
	Common Taro		100		33	67		3
	Yam		100		100			1
	Pana		100		100			1
	Cassava		33	67	33	67		3
BEANS	Beans		100		100			1
CABBAGE	Hibiscus Cabbage		60	40	60	20	20	5
VEGETABLE	Tomato		100		100			1
FRUIT CROPS	Pineapple		100			100		1
	Paw Paw			100			100	1
	Banana		100			100		1
NUT TREES	Betel Nut		100			100		1
Number of observations		6	35	14	20	33	2	55

19.9 Sale volumes are low to average while prices are average to good.

19.10 A summary of prices in the Auki market is as follows:

crop/commodity		<--- price SI$ in 1988 ---> at 25 May		at 15 October						
sweet potato		.29	.31	.97	.38	.62				
taro	common			.50	.67					
	Hong Kong	.29		.32						
pana		.25	.32							
yam		.20	.23							
coconut	dry	.08		.13						
	green	.33		.27						
banana	sweet	.17		.25						
	cooking	.25		.43						
pumpkin		.20		.29						
melon				.71	.83					
pumpkin tips				.46						
taro leaf				.67						
paw paw				.31						
pineapple		.19		.36	.50	.38	.46	.50	.44	.39
hibiscus cabbage		.15		.47	.67	.27				
chinese cabbage				.31						
capsicum pepper				1.00	4.00					
tomato				.33						
watercress				.29						
shallot				1.00						
snake bean				.40						
long bean		1.00								
wing bean		.40								
cucumber		.15								
peanuts		4.00		4.00	3.14					
mangrove fruits				.22						
sugar cane		.11								
ngali nut		.50		2.00						
betel nut		.50		2.00	2.00					
	leaf			3.00						
	stick			1.00						
tobacco				10.00						

19.11 Table 19.5 summarises marketing problems. To the right of the table are the proportion of cases by severity of problem. These are combined with crop type in the body of the table to show the "index of severity". In this index "no problem" is weighted "0", "slight problem" is weighted "0.5", and "severe problem" is weighted "1.0". Thus if all cases registered a severe problem the index would be "1.0".

Table: 19.5
MARKETING PROBLEMS
Number of observations = 55

	⟨--- crop type ---⟩			⟨--- severity of problem ---⟩		
	coconut and cocoa	root crops	other crops	none	slight	severe
	(index of severity)			(% cases)		
terrain too difficult				100		
distance too great		0.0		95	5	
not enough time/labour	0.1	0.0	0.0	82	11	7
transport cost too high	0.0	0.1	0.0	82	13	5
low price at market	0.1	0.1	0.0	65	29	5
lack of transport	0.0	0.0		91	2	7
unreliable transport		0.0		95	2	4
risk of not selling enough	0.0	0.0	0.0	89	11	
crop damage in transit				100		
administrative restrictions		0.0		98	2	
quarantine control				100		
other problem				100		

Note: "Index of Severity is a weighted summary of severity of marketing problems.
It falls in the range 0 to 1 where 0.0 = no marketing problem
0.5 = slight marketing problem
1.0 = severe marketing problem

19.12 For the most part problems are slight, mostly on transport cost and poor prices at market.

Annex: 1
CROP NAMES AND CODES

A1.1 The following list describes the hierarchical coding sequence used by AES in farming systems surveys to describe crop types. The list may be added to by inserting other crops of interest within the appropriate category.

A1.2 At the garden level only broad distinctions are made between cleared land, tree crops, short term cash crops, and food crops. Only single digit numeric codes are permitted at this level and these do not distinguish between crop type or mixtures. They do, however, provide important information about the structure of the holding. Code "1" for instance specifies "tree crops".

A1.3 At the plot level alphabetical codes are used to describe crop mixtures. These are used to describe cropping patterns and the analysis of labour by crop. Letter codes are strung together so there is no pre-set limit on the complexity of mixtures described. Some simplification is introduced within the code categories themselves. The dominant crop is listed first and other crops are listed to the right in decreasing order of importance. The string code then takes the form of an alphabetical "number", where the most significant characters are to the left and the least significant to the right. Forinstance "a" specifies "cleared land", while "rvgfl" specifies a mixture in decreasing order of importance of "sweet potato, cassava, cabbage, beans, banana".

A1.4 At the yield and marketing levels it is necessary to specify exactly the crop under study, and so a unique three-digit numeric code is assigned to each crop. The list need not be complete and may be added to as necessary since "spare codes" are available. Forinstance "613" specifies "pineapple".

Table: A1.1
CROP NAMES AND CODES

garden		plot	yield and marketing		scientific name
code	name	code	code	name	
0	cleared	a	100	CLEARED (unplanted)	
1	tree crops	b	200	COCONUT	Cocos nucifera
			210	Local Tall	
			211	Rennel	
			212	Dwarf Hybrid	
			219	Other	
			250	Copra	
1	tree crops	c	300	COCOA	Theobroma cacao
			310	Cocoa green beans	
			311	Cocoa dry beans	
		d		Pasture	
3	food crops		400	ROOT CROPS	
		r	410	Sweet Potato	Ipomoea batatas
		s	411	Taro Common	Colocasia esculenta
		s	412	Giant	Alocasia micorhiza
		s	413	Hong Kong	Xanthosoma saggitifolium
		s	414	Swamp	Cytosperma chamissonis
		t	415	Yam	Dioscorea alata
		u	416	Pana	Dioscorea esculenta
		v	417	Cassava	Manihot esculenta
		w	419	Other root crop	
3	food crops	e	430	GRAIN CROPS	
			431	Corn	Zea mays
			432	Peanuts	Arachis hypogaea
			439	Other grain crop	
3	food crops	f	440	BEANS	
			441	Long bean	Phaseolus vulgaris
			442	Wing bean	Psophocarpus tetragonolobus
			443	Snake bean	Trichosanthes cucumerina
			444	Mung bean	Phaseolus aureus
			445	Pigeon pea	Cajanus cajan
			449	Other bean	

3	food crops	g	450	CABBAGE	
			451	Hibiscus cabbage	Hibiscus manihot
			452	Kangkong	
			453	Chinese cabbage	Brassica chinensis
			454	English cabbage	Brassica compestis
			455	Watercress	
			459	Other cabbage	
3	food crops	h	460	VEGETABLE	
			461	Pumpkin	Cucurbita maxima
			462	Cucumber	Cucumis sativus
			463	Shallot	Allium spp.
			464	Onion	Allium cepa
			465	Tomato	Lycopersicon esculentum
			466	Okra	Hibiscus esculentus
			467	Egg plant	Solanum melongena
			468	Green pepper (sweet)	Capsicum annuum
			479	Other vegetable	
2	short term cash crops	i	500	SPICES	
			511	Chilli pepper	Capsicum spp.
			512	Pepper corn	Piper nigrum
			513	Turmeric	Curcuma domestica
			514	Cardamom	Ellettaria cardamomum
			515	Cinnamon	Cinnamomum zeylanicum
			516	Ginger	Zingiber officinale
			517	Garlic	Allium sativum
			518	Vanilla	Vanilla fragrans
			529	Other spice	
2/3	cash/food crops	j	600	FRUIT CROPS	
			611	Water melon	Citrullus lanatus
			612	Rock melon	
			613	Pineapple	Ananas comosus
			614	Paw Paw	Carica papaya
			615	Passion fruit	Passiflora edulus f. flavicarpa
			619	Other fruit crop	
1	tree crops	k	620	FRUIT TREES	
			621	Guava	Psidium guajava
			622	Mango	Manqifera indica
			623	Soursop	
			624	Local Apple	
			625	Malayan Apple	Eugenia malaccensis
			626	Avocado	Persea americana
			629	Other fruit tree	

3	food crops	l	630	BANANA	*Musa spp.*
			631	Cooking banana	
			632	Sweet banana	
			639	Other banana	
1	tree crops	m	640	CITRUS TREES	
			641	Orange	*Citrus sinensis*
			642	Lime	*Citrus aurantifolia*
			643	Grapefruit	*Citrus paradisi*
			644	Pomelo	*Citrus grandis*
			649	Other citrus	
1	tree crops	n	650	NUT TREES	
			651	Ngali Nut	*Canarium spp.*
			652	Cut Nut	*Barringtonia spp.*
			653	Betel Nut	*Areca catechu*
			654	Cashew Nut	*Anacardium occidentale*
			655	Alite Nut	*Terminalia catappa*
			659	Other Nut	
2	short term cash crops	o	660	SUGAR CANE	
			661	Sugar cane	*Saccharum spp.*
			662	Pit Pit	*Saccharum edule*
			669	Other	
1	tree crops	p	700	FOOD/BUILDING TREE	
			701	Breadfruit	*Artocarpus altilis*
			702	Sago palm	*Metroxylon spp.*
			703	Bamboo	*Nastus spp.*
			709	Other tree	
2	short term cash crops	q	800	Tobacco	*Nicotiana tabacum*

Annex: 2
LABOUR BUDGETS

A2.1 Sunmmaries of labour in the main body of the report are derived from labour budgets shown in tables A2.1 to A2.9, each covering a major land or crop operation:

Table	Operation
A2.1	Land Clearance
A2.2	Cultivation
A2.3	Planting
A2.4	Tree Crops Establishment
A2.5	Tree Crops Maintenance
A2.6	First Weeding
A2.7	Second Weeding
A2.8	Third Weeding
A2.9	Harvesting

A2.2 Each table is divided into two sub-tables, named "a" and "b". Part "a" expresses budgets in the form of labour per hectare. Part "b" converts these results to labour per holding, based on mean holding sizes previously derived.

A2.3 Tables in "part a" are divided into two main components. Part "i" expresses "labour input by main crop growing in the plot". This is the measured labour input from field data and is derived from a subsample of plot observations. To the left of the table is the main crop type, which is the dominant crop in a mixture. In the first column of the table is the number of plots on which observations were made, and in the second column is the mean area of observed plots. The third column summarises the average number of times per year that the operation is performed in a cropping sequence, and the fourth column expresses the average number of hours worked per day.

A2.4 Within the box are labour data expressed in terms of seasonal (single crop) and annual (crop sequence) labour input, broken down by men, women and paid labour. The wage cost of paid labour is shown in the right-most column. In this, hours are converted to days by dividing by the average number of hours worked per day. This then takes account of "unproductive" time such as for travel to and from the garden, and expresses labour in terms of actual time taken. It does not, however, take account of different agricultural operations which may take place on the same day for instance where a morning might be spent clearing a plot while the afternoon is spent in weeding. Commonly work is split between the cool hours of the morning and late afternoon and so such circumstances should not generally arise.

A2.5 Below is "part ii" of the table, in which the composition of labour input is shown in more detail. The first four columns show the average number of workers in each category. Within the box is a summary of the table above, in which the % contribution of men, women and paid labour is shown.

A2.6 "Part b" of the table is on the page following "part a", in which annual labour per hectare is converted to annual labour per holding based on mean holding areas recorded for each given crop and operation - since each sub-sample will differ from the others. These are shown in the upper part of the table in two forms, as work hours and as work days by category of labour. The annual wage labour cost is shown in the far right column of the table.

A2.7 Below is the labour budget expressed in terms of time per household labour unit. In this it is assumed that communal labour is reciprocated and so balances out. Total labour input may therefore be expressed simply in terms of family labour. Wage labour is external and is therefore given the adult equivalent "weighting" of 1. Family labour is weighted according to the age composition of the family, analysed in chapter 3.

A2.8 Each set of tables for an operation is accompanied by a diagram in which the annual days of labour per holding are summarised by crop and by labour category.

A2.9 Various points should be noted about the derivation of labour budgets:

i) They are expressed in the form of "models" which are based on a sub-sample of observations. These are derived from interview, not direct measurement, although care is taken to minimise recall periods. Labour budgets are built up from a mosaic of labour records.

ii) Crop categories are summaries of complex mixtures in which the crop listed is dominant. Labour data are thus compatible with cropping pattern data and represents actual field conditions. No attempt is made to restrict or control the conditions under observation.

iii) Each table shows the labour input for an operation which is conducted. The tables do not show the extent to which operations may be missed or combined. Such refinements are difficult to include without a more complex, and therefore more costly and time consuming, survey design. The analysis therefore tends to be conservative since it does not take account of possible economies in combined operations.

iv) Caution should be exercised in interpreting results from few observations since labour data on complex systems are very variable.

v) Labour, although of central importance in the agricultural economy, is not necessarily economically optimising. Often labour has an important social character in which households will group together and "share" labour. Differences in site and labour composition, together with the social character of some labour, introduce considerable variability into results.

Table: A2.1
LABOUR OPERATIONS ON LAND CLEARANCE (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	81	0.713	1.37	4.6	280	304	49	867	187	44.99
Cleared land :	2	0.077	1.00	3.0	312			312	104	
Coconut :	1	1.500	1.00	7.0	1176	392		1568	224	
Cocoa :	3	0.583	1.00	4.0	48	28	200	276	69	60.00
Grain crops :	1	0.026	1.00	8.0		308		308	39	
Fruit crops :	3	0.123	1.00	7.7	230	170		400	52	
Sweet potato :	51	1.047	1.61	4.4	327	346	54	1169	264	62.00
Taro :	13	0.024	1.00	4.5	138	379	46	563	124	33.24
Yam :	4	0.027	1.00	5.0	362			362	72	
Pana :	3	0.037	0.67	5.0	37	251		192	38	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.0	0.7	2.2	3.8	44	48	8
Cleared land :	8.0			8.0	100		
Coconut :	3.0	1.0		4.0	75	25	
Cocoa :	1.3	0.3	3.3	5.0	17	10	72
Grain crops :		1.0		1.0		100	
Fruit crops :	1.0	0.3		1.3	57	43	
Sweet potato :	0.8	0.8	2.9	4.5	45	48	7
Taro :	0.4	0.7	1.5	2.6	25	67	8
Yam :	1.0			1.0	100		
Pana :	0.3	1.0		1.3	13	87	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON LAND CLEARANCE (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SIS)
Total :	0.832	660	306	41	106	54	10	170	20
Cleared land :	0.024	7			2			2	
Coconut :	0.451	530	177		76	25		101	
Cocoa :	0.111	5	3	22	1	1	6	8	7
Grain crops :	0.001		0			0		0	
Fruit crops :	0.013	3	2		0	0		1	
Sweet potato :	0.210	110	117	18	25	26	4	55	13
Taro :	0.016	2	6	1	0	1	0	2	1
Yam :	0.002	1			0			0	
Pana :	0.003	0	1		0	0		0	
Other	0.001								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	322	161	41	51	29	5	68	32
Cleared land	4			1			100	
Coconut	259	93		37	13		75	25
Cocoa	3	2	22	1	0	3	63	37
Grain crops		0			0			100
Fruit crops	1	1		0	0		57	43
Sweet potato	54	61	18	12	14	2	49	51
Taro	1	3	1	0	1	0	27	73
Yam	0			0			100	
Pana	0	0		0	0		13	87

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.2
LABOUR OPERATIONS ON CULTIVATION (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	76	0.057	1.66	4.4	323	263	8	985	225	9.26
Cocoa :	1	0.500	1.00	3.0	180			180	60	
Grain crops :	1	0.026	1.00	4.0	615			615	154	
Sweet potato :	51	0.062	1.98	4.7	260	356	12	1244	266	13.09
Taro :	16	0.026	1.06	3.6	514	77	1	629	177	2.28
Yam :	4	0.027	1.00	4.0	362			362	91	
Pana :	3	0.037	0.67	5.0	289	214		335	67	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.9	0.7	0.3	1.9	54	44	1
Cocoa :	1.0			1.0	100		
Grain crops :	1.0			1.0	100		
Sweet potato :	0.9	0.8	0.4	2.1	41	57	2
Taro :	0.8	0.4	0.1	1.4	87	13	0
Yam :	1.0			1.0	100		
Pana :	1.3	0.7		2.0	57	43	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON CULTIVATION (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total	0.832	139	150	5	33	32	1	66	3
Cocoa	0.111	20			7			7	
Grain crops	0.001	1			0			0	
Sweet potato	0.210	108	148	5	23	32	1	56	3
Taro	0.016	9	1	0	2	0	0	3	0
Yam	0.002	1			0			0	
Pana	0.003	1	0		0	0		0	
Other	0.489								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	68	79	5	16	17	1	48	52
Cocoa	10			3			100	
Grain crops	0			0			100	
Sweet potato	53	78	5	11	17	1	42	58
Taro	4	1	0	1	0	0	87	13
Yam	0			0			100	
Pana	0	0		0	0		57	43

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.3
LABOUR OPERATIONS ON PLANTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: men (hours/ha)	labour input: per season: women (hours/ha)	labour input: per season: paid (hours/ha)	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	81	0.095	1.60	4.6	140	372	7	833	181	5.77
Coconut :	1	1.500	1.00	7.0	784	261		1045	149	
Cocoa :	3	0.583	1.00	3.3	88	28	67	183	55	40.00
Grain crops :	1	0.026	1.00	4.0	615			615	154	
Fruit crops :	3	0.123	1.00	7.7	121	121		242	32	
Sweet potato :	52	0.066	1.96	5.0	105	524	7	1247	251	6.68
Taro :	14	0.028	1.00	3.4	122	100		222	65	
Yam :	4	0.027	1.00	3.8	387	38		425	113	
Pana :	3	0.037	0.67	2.7	214	214		285	107	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.5	1.1	0.2	1.8	27	72	1
Coconut :	3.0	1.0		4.0	75	25	
Cocoa :	0.7	0.3	1.7	2.7	48	15	36
Grain crops :	1.0			1.0	100		
Fruit crops :	1.0	1.0		2.0	50	50	
Sweet potato :	0.3	1.3	0.2	1.9	17	82	1
Taro :	0.5	0.8		1.3	55	45	
Yam :	1.3	0.3		1.5	91	9	
Pana :	1.0	0.7		1.7	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON PLANTING (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total :	0.832	412	340	10	63	62	3	128	6
Coconut :	0.451	354	118		51	17		67	
Cocoa :	0.111	10	3	7	3	1	2	6	4
Grain crops :	0.001	1			0			0	
Fruit crops :	0.013	2	2		0	0		0	
Sweet potato :	0.210	43	216	3	9	44	1	53	1
Taro :	0.016	2	2		1	0		1	
Yam :	0.002	1	0		0	0		0	
Pana :	0.003	0	0		0	0		0	
Other	0.025								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	201	179	10	31	33	1	55	45
Coconut	172	62		25	9		75	25
Cocoa	5	2	7	1	0	1	76	24
Grain crops	0			0			100	
Fruit crops	1	1		0	0		50	50
Sweet potato	21	114	3	4	23	0	17	83
Taro	1	1		0	0		55	45
Yam	0	0		0	0		91	9
Pana	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.4
LABOUR OPERATIONS ON ESTABLISHMENT (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	2	0.130	1.00	8.0	371			371	46	
Cocoa :	2	0.130	1.00	8.0	371			371	46	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.0			1.0	100		
Cocoa :	1.0			1.0	100		

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON ESTABLISHMENT (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total :	0.832	41			5			5	
Cocoa :	0.111	41			5			5	
Other	0.721								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	20			3			100	
Cocoa	20			3			100	

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.5
LABOUR OPERATIONS ON MAINTENANCE (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: men (hours/ha)	labour input: per season: women (hours/ha)	labour input: per season: paid (hours/ha)	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	8	1.368	1.63	5.9	105	19	0	201	34	5.36
Coconut :	3	3.021	1.00	5.0	88		1	89	18	14.29
Cocoa :	5	0.376	2.00	6.4	116	30		292	46	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	1.1	0.3	0.1	1.5	85	15	0
Coconut :	1.0		0.3	1.3	99		1
Cocoa :	1.2	0.4		1.6	80	20	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON MAINTENANCE (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost ($IS)
Total	:	0.832	65	7	0	12	1	0	13	6
Coconut	:	0.451	40		0	8		0	8	6
Cocoa	:	0.111	26	7		4	1		5	
Other		0.270								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	32	3	0	6	1	0	91	9
Coconut	19		0	4		0	100	
Cocoa	13	3		2	1		80	20

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.6
LABOUR OPERATIONS ON FIRST WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season men (hours/ha)	per season women (hours/ha)	per season paid (hours/ha)	per year hours (hrs/ha)	per year days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	73	0.070	1.55	4.8	134	476	2	947	198	1.10
Coconut :	1	0.093	1.00	3.0	97	97		194	65	
Cocoa :	3	0.265	1.00	3.0	78		40	118	39	26.67
Grain crops :	1	0.026	1.00	4.0	308	308		616	154	
Fruit crops :	3	0.123	1.00	6.3	81	81		162	26	
Sweet potato :	45	0.072	1.89	5.1	103	509		1156	228	
Taro :	12	0.032	1.00	4.3	726	587		1313	309	
Yam :	4	0.027	1.00	4.0	244	269		513	128	
Pana :	4	0.031	1.00	4.8		761		761	160	

	average number of workers: men	women	paid	total	% contribution: men	women	paid
ii) Labour composition							
All plots summary :	0.4	1.3	0.4	2.1	22	78	0
Coconut :	3.0	3.0		6.0	50	50	
Cocoa :	1.7		10.0	11.7	66		34
Grain crops :	1.0	1.0		2.0	50	50	
Fruit crops :	1.0	1.0		2.0	50	50	
Sweet potato :	0.3	1.4		1.7	17	83	
Taro :	0.2	1.0		1.2	55	45	
Yam :	0.8	1.0		1.8	48	52	
Pana :		1.8		1.8		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON FIRST WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	work days total	labour cost (SI$)
Total :	0.832	107	259	4	29	57	1	88	3
Coconut :	0.451	44	44		15	15		29	
Cocoa :	0.111	9		4	3		1	4	3
Grain crops :	0.001	0	0		0	0		0	
Fruit crops :	0.013	1	1		0	0		0	
Sweet potato :	0.210	41	202		8	40		48	
Taro :	0.016	12	9		3	2		5	
Yam :	0.002	0	1		0	0		0	
Pana :	0.003		2			0		0	
Other	0.025								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours men	work hours women	work hours paid	work days men	work days women	work days paid	% contribution to family labour men	% contribution to family labour women
Labour units available	2.05	1.90	1.00					
Total	52	136	4	14	30	1	29	71
Coconut	21	23		7	8		50	50
Cocoa	4		4	1		1	100	
Grain crops	0	0		0	0		50	50
Fruit crops	1	1		0	0		50	50
Sweet potato	20	106		4	21		17	83
Taro	6	5		1	1		55	45
Yam	0	0		0	0		48	52
Pana		1			0			100

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.7
LABOUR OPERATIONS ON SECOND WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: men (hours/ha)	labour input: per season: women (hours/ha)	labour input: per season: paid (hours/ha)	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	30	0.052	1.93	5.0	94	352		862	171	
Coconut :	1	0.238	1.00	4.0	252	84		336	84	
Cocoa :	1	0.046	1.00	4.0	173			173	43	
Grain crops :	1	0.026	1.00	4.0	308	308		616	154	
Sweet potato :	17	0.061	2.65	6.1	65	411		1260	208	
Taro :	5	0.019	1.00	3.2		379		379	118	
Yam :	3	0.023	1.00	4.0	326	326		652	163	
Pana :	2	0.025	1.00	4.0		161		161	40	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.4	1.1		1.5	21	79	
Coconut :	3.0	1.0		4.0	75	25	
Cocoa :	2.0			2.0	100		
Grain crops :	1.0	1.0		2.0	50	50	
Sweet potato :	0.2	1.3		1.5	14	86	
Taro :		1.0		1.0		100	
Yam :	1.0	1.0		2.0	50	50	
Pana :		1.0		1.0		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON SECOND WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SIS)
Total :	0.832	170	274		39	49		89	
Coconut :	0.451	114	38		28	9		38	
Cocoa :	0.111	19			5			5	
Grain crops :	0.001	0	0		0	0		0	
Sweet potato :	0.210	36	228		6	38		44	
Taro :	0.016		6			2		2	
Yam :	0.002	1	1		0	0		0	
Pana :	0.003		0			0		0	
Other	0.038								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	83	144		19	26		38	62
Coconut	55	20		14	5		75	25
Cocoa	9			2			100	
Grain crops	0	0		0	0		50	50
Sweet potato	18	120		3	20		14	86
Taro		3			1			100
Yam	0	0		0	0		50	50
Pana		0			0			100

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.8
LABOUR OPERATIONS ON THIRD WEEDING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	8	0.052	1.75	4.5	139	310		786	175	
Cocoa :	1	0.046	1.00	4.0	173			173	43	
Fruit crops :	1	0.036	3.00	4.0	225			675	169	
Sweet potato :	2	0.134	3.00	8.0	357	357		2142	268	
Taro :	4	0.016	1.00	3.0		441		441	147	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.6	0.8		1.4	31	69	
Cocoa :	2.0			2.0	100		
Fruit crops :	1.0			1.0	100		
Sweet potato :	1.0	1.0		2.0	50	50	
Taro :		1.0		1.0		100	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON THIRD WEEDING (per holding)

i) Total time worked

	mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SIS)
Total :	0.832	253	232		35	30		66	
Cocoa :	0.111	19			5			5	
Fruit crops :	0.013	9			2			2	
Sweet potato :	0.210	225	225		28	28		56	
Taro :	0.016		7			2		2	
Other	0.482								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	123	122		17	16		52	48
Cocoa	9			2			100	
Fruit crops	4			1			100	
Sweet potato	110	118		14	15		50	50
Taro		4			1			100

Derived from household composition labour availability
% contribution to family labour is derived from the table above

Table: A2.9
LABOUR OPERATIONS ON HARVESTING (per hectare)

	number of obs (plots)	mean plot area (ha)	operation times per year	average hours worked per day	labour input: per season: hours/ha: men	labour input: per season: hours/ha: women	labour input: per season: hours/ha: paid	labour input: per year: hours (hrs/ha)	labour input: per year: days (d/ha)	labour cost ($/ha/yr)
i) Labour input by main crop growing in the plot										
All plots summary :	56	0.090	2.52	2.3	15	674		1734	759	
Cocoa :	3	0.515	9.00	4.3	43	16		533	123	
Sweet potato :	40	0.071	2.53	2.3		730		1843	810	
Taro :	11	0.053	1.00	2.0	14	723		737	368	
yam :	2	0.030	1.00	1.0	271	271		542	542	

	average number of workers: men	average number of workers: women	average number of workers: paid	average number of workers: total	% contribution: men	% contribution: women	% contribution: paid
ii) Labour composition							
All plots summary :	0.1	1.1		1.2	2	98	
Cocoa :	1.3	0.3		1.7	73	27	
Sweet potato :		1.2		1.2		100	
Taro :	0.2	1.0		1.2	2	98	
yam :	1.0	1.0		2.0	50	50	

Note : 1. "Operation times per year" is the average number of times the operation is performed per year.
2. "Hours per year" is the sum of hours per season multiplied by times per year.

LABOUR OPERATIONS ON HARVESTING (per holding)

i) Total time worked

		mean holding area (ha)	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	work days: total	labour cost (SI$)
Total	:	0.832	44	415		11	180		191	
Cocoa	:	0.111	43	16		10	4		14	
Sweet potato	:	0.210		387			170		170	
Taro	:	0.016	0	12		0	6		6	
yam	:	0.002	1	1		1	1		1	
Other		0.493								

Derived from plot details aggregated over entire holding

ii) Time worked per labour unit

	work hours: men	work hours: women	work hours: paid	work days: men	work days: women	work days: paid	% contribution to family labour: men	% contribution to family labour: women
Labour units available	2.05	1.90	1.00					
Total	21	219		5	95		10	90
Cocoa	21	8		5	2		73	27
Sweet potato		204			90			100
Taro	0	6		0	3		2	98
yam	0	0		0	0		50	50

Derived from household composition labour availability
% contribution to family labour is derived from the table above

LAND CLEARANCE
Annual Labour per Holding

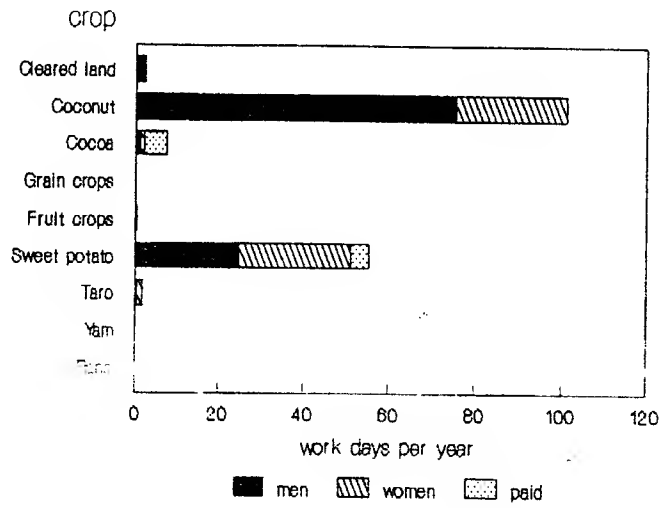


Diagram: A2.1

CULTIVATION
Annual Labour per Holding

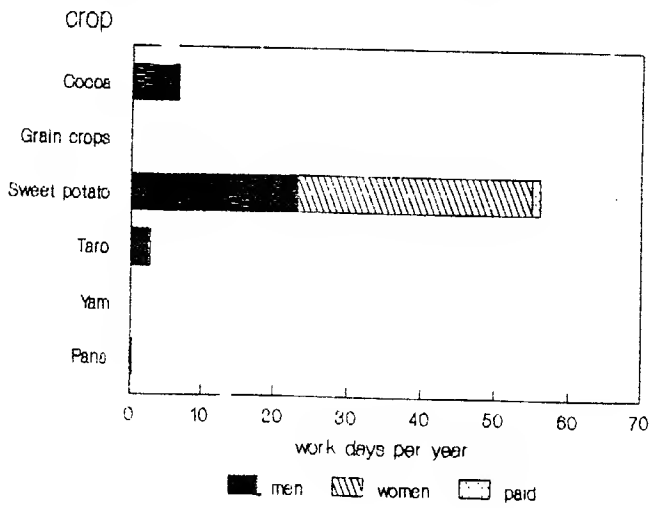


Diagram: A2.2

PLANTING
Annual Labour per Holding

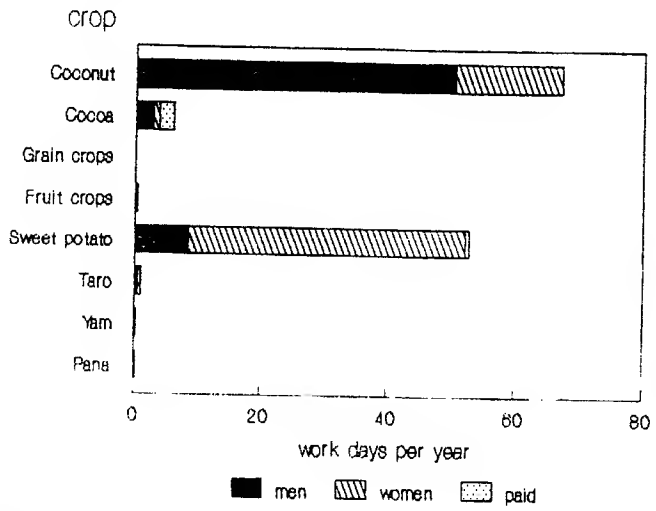


Diagram: A2.3

TREE CROPS ESTABLISHMENT
Annual Labour per Holding

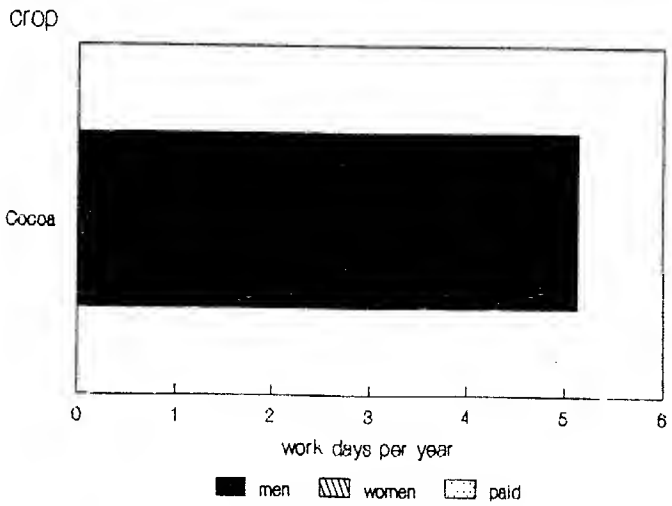


Diagram: A2.4

TREE CROPS MAINTENANCE

Annual Labour per Holding

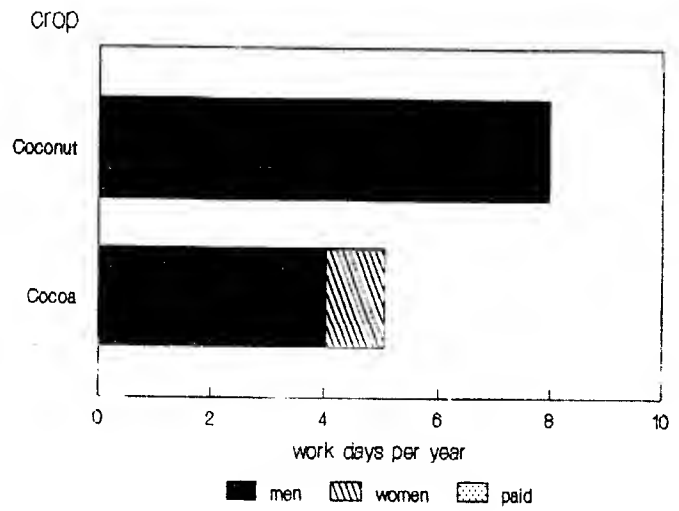


Diagram: A2.5

FIRST WEEDING

Annual Labour per Holding

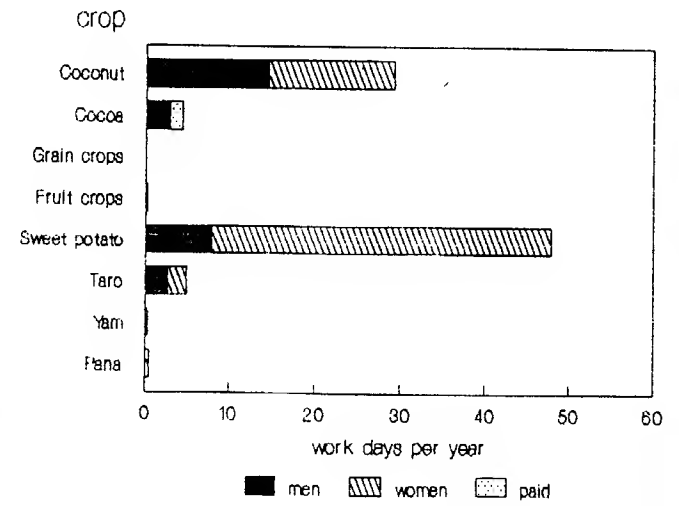


Diagram: A2.6

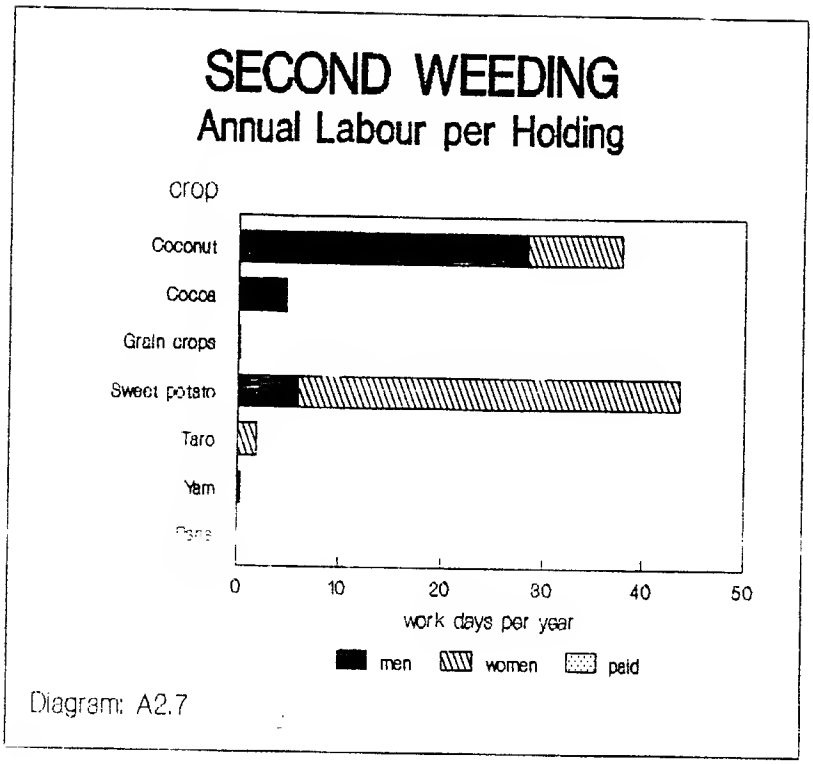


Diagram: A2.7

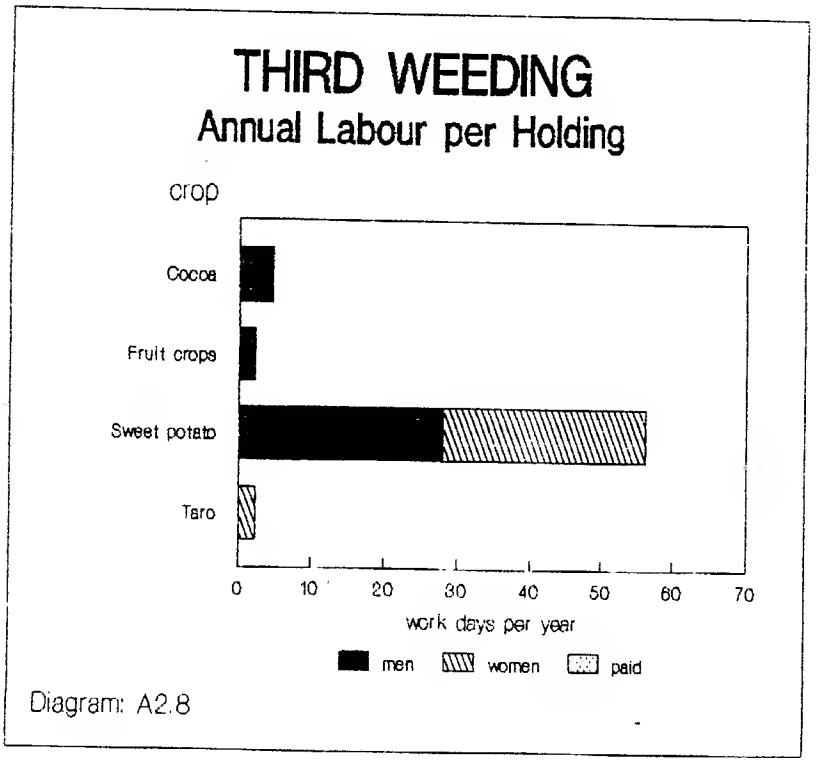


Diagram: A2.8

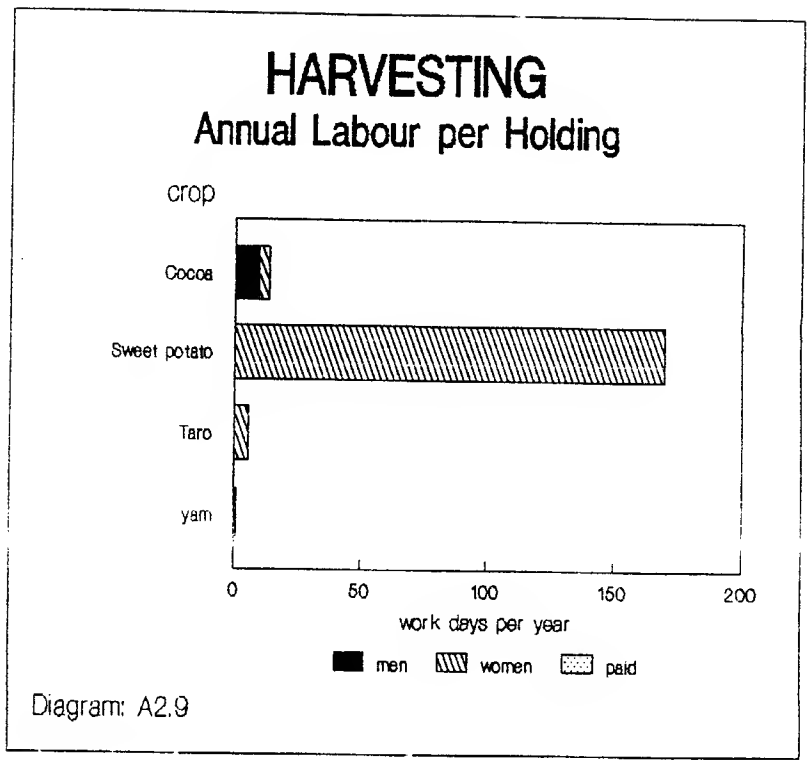

HARVESTING
Annual Labour per Holding
crop
Cocoa
Sweet potato
Taro
yam
0
50
100
150
200
work days per year
men
women
paid

Diagram: A2.9

Annex: 3
CROP DAMAGE

A3.1 The following analysis of crop damage is based on observations of crop mixtures at the plot level. Tables show the dominant crop growing in the mixture, but damage encountered may refer to other crops in the plot. In the present analysis it is possible only to present results at the plot level, and not at the crop level.

Table: A3.1a
CROP DAMAGE DUE TO INSECTS - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:		little	considerable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		43	10	4	1	176	33	67
cleared land	a					10		100
coconut	b	1				11	9	91
cocoa	c	1				10	10	90
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	34	6	4	1	111	41	59
taro	s	5	3			18	44	56
yam	t					2		100
pana	u	1	1			5	40	60
cassava	v	1				2	50	50

ii) % crop area affected

extent of damage:		little	considerable	severe	crop devastated	% affected	% unaffected
% total cropped area		9	3			13	88
cleared land	a						100
coconut	b	6				6	94
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r	25	13			38	63
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1b
CROP DAMAGE DUE TO INSECTS - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		24	4	2		176	17	83
cleared land	a					10		100
coconut	b	4	2	2		11	73	27
cocoa	c	5	1			10	60	40
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	13	1			111	13	87
taro	s	1				18	6	94
yam	t					2		100
pana	u					5		100
cassava	v	1				2	50	50

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		28	9			38	63
cleared land	a						100
coconut	b	35	12			47	53
cocoa	c	50	25			75	25
grain crops	e						100
fruit crops	j						100
sweet potato	r	13				13	88
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.1c
CROP DAMAGE DUE TO INSECTS - AFFECTING ROOTS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		17	4			176	12	88
cleared land	a					10		100
coconut	b	1				11	9	91
cocoa	c					10		100
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	13	2			111	14	86
taro	s	2	2			18	22	78
yam	t					2		100
pana	u	1				5	20	80
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		6				6	94
cleared land	a						100
coconut	b	6				6	94
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r	13				13	88
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a
CROP DAMAGE DUE TO DISEASE - AFFECTING LEAVES

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		7	14	4	1	176	15	85
cleared land	a					10		100
coconut	b	1	1			11	18	82
cocoa	c	2				10	20	80
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	1	4	1	1	111	6	94
taro	s	3	8	2		18	72	28
yam	t			1		2	50	50
pana	u		1			5	20	80
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		3				3	97
cleared land	a						100
coconut	b	6				6	94
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2a
CROP DAMAGE DUE TO DISEASE - AFFECTING FRUITS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		3	10		1	176	8	92
cleared land	a					10		100
coconut	b	1	4			11	45	55
cocoa	c		6		1	10	70	30
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	2				111	2	98
taro	s					18		100
yam	t					2		100
pana	u					5		100
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		9	16		3	28	72
cleared land	a						100
coconut	b	18	18			35	65
cocoa	c		50		25	75	25
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.2c
CROP DAMAGE DUE TO DISEASE - AFFECTING ROOTS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		3	6		I	176	5	95
cleared land	a				I	10		[illegible]
coconut	b				I	11		100
cocoa	c				I	[illegible]		[illegible]
grain crops	e				I	1		100
fruit crops	j				I	6		100
sweet potato	r	3	6		I	111	8	92
taro	s				I	18		100
yam	t				I	2		100
pana	u				I	5		100
cassava	v				I	2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.3
CROP DAMAGE DUE TO HUMANS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		2			I 176		1	99
cleared land	a				I 10			100
coconut	b	1			I 11		9	91
cocoa	c				I 10			100
grain crops	e				I 1			100
fruit crops	j				I 6			100
sweet potato	r	1			I 111		1	99
taro	s				I 18			100
yam	t				I 2			100
pana	u				I 5			100
cassava	v				I 2			100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		9			I	9	91
cleared land	a				I		100
coconut	b	18			I	18	82
cocoa	c				I		100
grain crops	e				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.4
CROP DAMAGE DUE TO FIRE

i) Frequency of plots damaged

extent of damage:		little	considerable	severe	crop devastated	total # plots	% affected	% unaffected
all plots			1			176	1	99
cleared land	a					10		100
coconut	b		1			11	9	91
cocoa	c					10		100
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r					111		100
taro	s					18		100
yam	t					2		100
pana	u					5		100
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	considerable	severe	crop devastated	% affected	% unaffected
% total cropped area			9			9	91
cleared land	a						100
coconut	b		18			18	82
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.5
CROP DAMAGE DUE TO FLOOD

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		2	2		I	176	2	98
cleared land	a				I	10		100
coconut	b		1		I	11	9	91
cocoa	c				I	10		100
grain crops	e				I	1		100
fruit crops	j				I	6		100
sweet potato	r	1	1		I	111	2	98
taro	s				I	18		100
yam	t				I	2		100
pana	u	1			I	5	20	80
cassava	v				I	2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.6
CROP DAMAGE DUE TO WIND

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		2	1	2		176	3	97
cleared land	a					10		100
coconut	b	1	1	2		11	36	64
cocoa	c	1				10	10	90
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r					111		100
taro	s					18		100
yam	t					2		100
pana	u					5		100
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		3	16	9		28	72
cleared land	a						100
coconut	b	6	29	18		53	47
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.7
CROP DAMAGE DUE TO RATS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		26	48	3		176	44	56
cleared land	a					10		100
coconut	b	1				11	9	91
cocoa	c	4	3			10	70	30
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	20	44	3		111	60	40
taro	s		1			18	6	94
yam	t					2		100
pana	u					5		100
cassava	v	1				2	50	50

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		16	19			34	66
cleared land	a						100
coconut	b	6				6	94
cocoa	c	50	50			100	
grain crops	e						100
fruit crops	j						100
sweet potato	r	25	50			75	25
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.8
CROP DAMAGE DUE TO BIRDS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		16	5	1		176	13	88
cleared land	a					10		100
coconut	b	2				11	18	82
cocoa	c					10		100
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	13	5	1		111	17	83
taro	s					18		100
yam	t	1				2	50	50
pana	u					5		100
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area		9	3			13	88
cleared land	a						100
coconut	b	12				12	88
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r	13	13			25	75
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.9
CROP DAMAGE DUE TO BATS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		1				176	1	99
cleared land	a					10		100
coconut	b					11		100
cocoa	c	1				10	10	90
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r					111		100
taro	s					18		100
yam	t					2		100
pana	u					5		100
cassava	v					2		100

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area							100
cleared land	a						100
coconut	b						100
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.10
CROP DAMAGE DUE TO LIVESTOCK

i) Frequency of plots damaged

extent of damage:		little	considerable	severe	crop devastated	total # plots	% affected	% unaffected
all plots			2	2	I	176	2	98
cleared land	a				I	10		100
coconut	b				I	11		100
cocoa	c				I	10		100
grain crops	e				I	1		100
fruit crops	j				I	6		100
sweet potato	r		2	2	I	111	4	96
taro	s				I	18		100
yam	t				I	2		100
pana	u				I	5		100
cassava	v				I	2		100

ii) % crop area affected

extent of damage:		little	considerable	severe	crop devastated	% affected	% unaffected
% total cropped area					I		100
cleared land	a				I		100
coconut	b				I		100
cocoa	c				I		100
grain crops	e				I		100
fruit crops	j				I		100
sweet potato	r				I		100
taro	s				I		100
yam	t				I		100
pana	u				I		100
cassava	v				I		100

Note: The table of % area is only approximate due to rounding small numbers

Table: A3.11
CROP DAMAGE DUE TO OTHER FACTORS

i) Frequency of plots damaged

extent of damage:		little	consid-erable	severe	crop devastated	total # plots	% affected	% unaffected
all plots		7	3	1		176	6	94
cleared land	a					10		100
coconut	b					11		100
cocoa	c					10		100
grain crops	e					1		100
fruit crops	j					6		100
sweet potato	r	6	3	1		111	9	91
taro	s	1				18	6	94
yam	t					2		100
pana	u					5		100
cassava	v					2		100

Note: "Other" damage is caused by frogs

ii) % crop area affected

extent of damage:		little	consid-erable	severe	crop devastated	% affected	% unaffected
% total cropped area							100
cleared land	a						100
coconut	b						100
cocoa	c						100
grain crops	e						100
fruit crops	j						100
sweet potato	r						100
taro	s						100
yam	t						100
pana	u						100
cassava	v						100

Note: The table of % area is only approximate due to rounding small numbers

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